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## EDITORIAL NOTES—GAS, &c.

### Carbonization at the Southern Meeting.

A DIAGRAMMATIC representation of the transactions throughout its history, of the Southern District Association of Gas Engineers and Managers, would require a very high peak drawn in for the proceedings at the meeting last Thursday. The final report of the Naphthalene Investigation Committee (discussed in another article) would alone have carried the curve to a high place; but, in addition, there were two papers which gave rise to an immensity of discussion of a suggestive order, and which, we venture to think, will be read with avidity and profit. The first author was Mr. G. R. Love, of Guildford; and his theme was the experimental work he has been carrying out with vertical and inclined retorts. The second author was Mr. James Paterson, of Redhill; and his chosen subject was big makes of gas per ton.

The bold stand that Mr. Love made at the meeting of the Institution of Gas Engineers last June in hostility to vertical retorts as practicable means for carbonization, aroused the pleasurable anticipation of learning, through this paper, something more of his trials and troubles in investigating the system, and the reasons that had moved him to turn from it, and repose his faith in the inclined system, with varieties from the ordinary fashions in disposition and working. Gathering together the threads of his experience with the vertical retort, advantage is gained in the confirmation of the deductions drawn from the Cleethorpes experiments with the Settle-Padfield retort (as detailed by Mr. E. J. Brockway in his recent presidential address to the Eastern Counties Association) as to certain practices being wrong. But it does seem, in view of other experience, that Mr. Love cast the vertical retort adrift just at that stage where he had satisfied himself as to wrong and right conditions, and there and then relinquished further effort to master the remaining difficulties, which difficulties experience elsewhere indicates are amenable to engineering art. In saying this, we do not in any way intend to lessen the great credit attaching to the perseverance to a point and the skill that Mr. Love brought to bear upon his trials.

The first experimental vertical retort at Guildford contained a series of spiral vanes, which produced just the disastrous and beneficial effects that would be expected—the prevention, on the one hand, of the free evacuation of the retort, and consequent increase, instead of diminution, of the labour required; and, on the other hand, the conduction of heat, by the vanes, to the centre of the charge, resulting in a lessened fuel consumption. The vanes were discarded, and the retort was tried with a clear interior; and subsequently this particular retort was displaced by one of oval section. The lessons to be gathered from the Guildford experience, confirming as it does that at Cleethorpes, show up to a point conditions to avoid in vertical retort working; and therein is considerable value. When the retort was charged with small doses of coal, there was a higher yield of gas than when charged with large quantities; but there was variation in the illuminating power, according to the level at which the charge had arrived in the retort—the poor illuminating powers, of course, being produced by the great extent of the free space above the charge, when the latter was low in the retort. The best results were realized when the retorts were filled not quite to the top. There was a great deal said at the meeting about the essential to good carbonization results of maintaining constant conditions inside retorts, however disposed in settings; and an approximately unvarying line of charge in vertical retorts, with a moderate free space above, are, experience suggests, contributive to the best working. Depreciation of illuminating power is not the only evil resulting from over-exposure of the evolved gases. Both at Cleethorpes and at Guildford, identical trouble arose from accumulations of lamp-black and pitching-up when charges were low and free space excessive. Mr. Thomas Glover has hammered away at the importance of a moderate amount of radiant heat over the charge; and the same gentleman hints that Messrs. Woodall and Duckham will be able to say something of interest on this head when they publish details of their working at Bournemouth. The Guildford and the Cleethorpes experiments have certainly sensibly advanced the belief that, in vertical retort working, there is a point between the cramming of a retort with coal as in the Dessau system and the excessive free space that is obtained when charging in small amounts, by completely, or almost completely, discharging the retorts intermittently, at which results are the best, and the trouble is at a minimum.

A matter upon which information is still scarce is as to the fuel consumption in vertical retort working. In the Dessau system, with the 4 metre retorts, it is "about" 14 to 15 per cent.; but from Mariendorf with the longer retorts, and from the other experimental working, there is nothing definite yet to be said. Of course, with an independent experimental retort—owing to the losses of heat by radiation, by the external cooling influences, and by the fact that the expenditure of fuel is proportionately higher in the heating of a single retort than in the heating of a number in a bed, and a plurality of beds in a bench—one cannot get the exact data to warrant positive judgment or assertion on the point. Another of Mr. Love's difficulties was as to the heating of the verticals. His experience was very similar to that at Mariendorf up to November of last year in the trials with the 5 metre retorts. But that there is no insurmountable difficulty in the heating of verticals, Bournemouth, Mariendorf, and Dessau have now severally completely proved, and before them, and over many years, in the Scotch shale works. However, after Mr. Love inclined his retort to 60° and then to 45° (he has now a bed of eight retorts at this angle, still using a constant feed of small charges), he has secured satisfactory heats and a saving of fuel; and first troubles with lamp-black and so forth are now avoided. Mr. Love appears to be so satisfied with his working, that he would not hesitate to advise his Directors to proceed, as opportunity arises, with the reconstruction of further carbonizing plant on this system, the details concerning which must be obtained from the paper. Owing to the absence of the necessary coal-handling plant, and the resulting heavy charges for labour, the bed is not now working. If it had been, perhaps there would have been a little less inconclusiveness as to the results realized. When Mr. Love gets the best gas results by constant charging, the coke is poor; and this will not do. He believes—but he does not speak definitely—that the remedy for the inferior coke is in having retorts of 15 feet length, instead of 10 feet ones. However, he has achieved something in getting 12,000 cubic feet of gas per ton of coal carbonized with inclined retorts 10 feet long. It is hoped that working will be continued, and that supplemental experience will, in due time, be forthcoming.

The paper by Mr. Paterson was the first that he has presented to the Association; and it was in accordance with the fitness of things that he should have chosen for his subject one appertaining to carbonization, for the success of carbonization, on the charmingly simple lines as practised by Mr. R. O. Paterson at Cheltenham, has lost nothing by time of the professional esteem that it gained years ago—before, in fact, the author of the present paper had commenced to study its principles. The paper had an object that was felt rather than seen. It was to draw the members on the question of carbonization; and it abundantly succeeded—due largely to the designed nebulosity with which the composition surrounded Mr. Paterson's own views. But, briefly stated, the problem upon which he invited discussion was as to whether the advantage of higher makes per ton of coal carbonized was not counterbalanced by losses in

other directions resulting from the means employed to secure the higher make. He took the example of Redhill, where, in the last fifteen years, the yield of gas per ton has been increased by 1000 cubic feet. To this he ascribes a value of 1s. 5d.; and in opposition to this 1s. 5d., to gauge the ultimate utility of higher makes, he constructed a hypothetical and debatable list of losses. But the case he presented was mercilessly mauled by the ready debaters at the meeting. Just as Mr. Paterson fails to trace in the Redhill Gas Company's balance-sheets any valuable gain from the increased yield, so his numerous and hard-hitting critics failed to find in their own records those debits that he set against the change of practice that has produced the higher gas yield. Through increased production per ton, besides the saving in coal, carbonizing wages must on the total make of gas be decreased; although, theoretically, higher heats should occasion loss of ammonia. Mr. Arthur Valon, Mr. J. W. Helps, Mr. W. B. Randall, and Mr. A. F. Browne, fail to trace such an effect in the accounts; the cost of extra wear and tear produced by high heats is annihilated by the increased make per mouthpiece; fuel consumption per 1000 cubic feet of output is lessened by the increased production; and interest on capital outlay must, by the additional yield per ton, be reduced. On this point, Mr. Helps's statement is instructive, that in the coming winter 25 settings of eight retorts will meet his requirements, whereas, if the production had continued the same as two years ago, thirty settings would have been required. But the fact remains that the advantage of the greater make at Redhill has, so far as Mr. Paterson can find, no tangible existence; but he declines to accept the suggestion of Mr. A. Valon to translate himself back fifteen years, and, by limiting his production to that obtaining at the time, see what he will be able to trace in the accounts at the end of a year. He would in this way probably find some solution of the problem, which solution present conditions at Redhill deny him. But the seeming hesitancy of Mr. Paterson to accept the increased production as having anything more than a face value is banished by his disinclination to do anything other than he is now doing—that is, get the utmost from his coal that economical considerations will allow. We will only add that the axiom that "Gas should be taken from the retorts as fast as it is made," is held by Mr. Paterson to be the secret of successful carbonization; and, on this head, many gas managers should profit by reading the remarks of Mr. Helps as to the effect the use of retort governors has had in steadying the conditions within the retorts at Croydon, with resulting improvement both in production and illuminating power.

Next year the Association will give cordial welcome to Mr. Harold W. Woodall as President; and Mr. Norton H. Humphrys as Vice-President. Thus the south-western portion of the Association's district will, for the next two years, be prominently represented in the technical and other proceedings of the organization.

## The Naphthalene Inquiry, 1901-1906.

The investigation instituted in 1901, under the direction of the Southern District Association of Gas Engineers and Managers, into questions relating to the formation and the deposition of naphthalene has now been relinquished—for the time being, at least—owing to lack of available funds for its further pursuit. According to the final report on the investigation, which was presented at the meeting of the Association last week, "the main object of the inquiry was "to ascertain if it were possible to rearrange or alter the "working of the ordinary plant of a gas-works, so as to "effect the automatic and regular removal of the naphthalene "in the usual course of the manufacture, and thereby avoid "the necessity of special subsequent treatment." A glance at the report, and the exhaustive communications by Dr. Harold G. Colman, who acted as Technical Adviser of the Committee, will indicate that the Association may rightly compliment itself on having been the medium through which much valuable and most interesting work on the naphthalene question has been done, and all will share the regret of the Committee that the investigation has been stopped before its aims have been accomplished.

Probably very few members of the Association, and very few of the Companies who subscribed towards the expenses of the inquiry, expected a more conclusive issue of an investigation into a subject which had baffled independent inquirers for many years. The conditions of formation of naphthalene in the course of the carbonization of coal are still very imperfectly understood, while the conditions of its deposition from coal gas are even less fully comprehended. It was a task of stupendous dimensions which the Committee set themselves and Dr. Colman; and it is only by recognizing this fact that the seeming little which has been accomplished appears in its true proportions, and is seen to be something considerable. Moreover, the work done should, in fairness to the workers, be judged by the standard of knowledge of the subject when it was commenced; for contemporary research on the part of many investigators, both in this country and abroad, has, during the progress of the inquiry, extended very greatly our acquaintance with the questions involved. Dr. Colman freely acknowledges the good work which has been going on elsewhere while he has been busy on behalf of the Southern Association.

Much of this independent work has been directed towards grappling with the naphthalene trouble by "special subse-"quent treatment," which was—probably with the view of limiting the scope of the inquiry in the first instance—apparently expressly excluded from the Association's investigation. It would be absurd to complain of this limitation were it not for the fact that much of Dr. Colman's time has been devoted to studying the effect of the "Cyclone" tar-separator, working on the hot gas issuing from the foul main, in preventing subsequent deposition of naphthalene from the gas. This preliminary separation of tar by a "Cyclone" extractor involves, however, very special treatment of the gas, and the adoption of a new apparatus; and if it is conceded that special treatment and new apparatus are required to solve the naphthalene problem, it matters little whether they occur before or after the condensation of the gas. So far as one can judge from the present report, the preliminary "Cyclone" special treatment has not proved highly satisfactory; whereas it is recognized by Dr. Colman that success has been gained by treatment of the gas subsequent to condensation, either by oil-washing or oil-spraying ("carburation"). In view of the forced closing of the Association's inquiry, it seems a pity that one type of special treatment was studied to the exclusion of others which were reported to be achieving success. Investigations such as Dr. Colman, as the independent adviser of the Association, would have been in a position to make would really be invaluable in regard to both the oil-washing and the carburation processes.

One point in which treatment before condensation must obviously be superior to subsequent treatment is that, if successful, naphthalene stoppages in the condenser itself would be avoided. No doubt the Committee had this in mind in pursuing the investigations with the "Cyclone" tar-separator to the exclusion of subsequent treatment. But unfortunately the separator working on the hot gas did not in all cases prevent stoppages in the condenser. The failure of the "Cyclone" apparatus in this respect gave increased importance to the alternative treatment which was studied—viz., the addition of light oils to the gas in the condenser. Dr. Colman has, however, come to the conclusion that it is improbable that, as a commercial practice, this treatment can be carried out in an effective manner without the prior removal of the heavy tar-fog from the gas; and it was not possible for him to try the effect of the dual treatment. The trial will shortly be made elsewhere, however, with a more promising solvent in place of the light coal-tar oils previously used—carburetted water-gas tar. Doubtless Dr. Colman, or whoever is responsible for the trial, intends to select a suitable grade of the latter tar, or perhaps a distillate from it, as some specimens of carburetted water-gas tar would not prove entirely satisfactory for the purpose.

It would appear to be established, though the report does not say so in as many words, that naphthalene troubles can be avoided, as to the distributing system, by oil-washing or oil-spraying subsequent to condensation, and, as to the condenser and immediate connections, by a moderate addition of oil-vapours in the condenser itself, even without prior removal of heavy tar-fog. These are the practical conclusions; and it only remains for their effective utilization to ascertain the most suitable oil for use in each case, and the most practicable means or appliance for its application. Much remains to be done in regard to both these questions, notwithstanding the labours in the past of Messrs. Botley, Young and Glover, Bueb, Bell, Colson, and others. The more elusive problem, of how to avoid the formation of naphthalene without detriment to good carbonizing returns,

seems still far from solution, and is probably impossible of solution in general terms under prevailing modes of carbonization. It is a curious, but perhaps irrelevant, fact, that the tar thrown down in the condenser after tar-fog has been removed by the "Cyclone" separator, somewhat resembles in character the tar made in the Dessau vertical retorts, and the gas made by the latter is reported to be, to all intents and purposes, free from naphthalene.

## To Prevent Corruption.

However deep-seated may be the desire for absolute freedom from moral obliquity in all walks of life, there is little to give hope of human action receiving such ablution that the desire will ever change from the abstract state to that of actual consummation. The Millennium is not yet; and the law makers of the land find it somewhat difficult to keep pace with the demand for enactment having for its object the restraining from further encroachment and the reclaiming of ground lost in connection with wrong-doing in human affairs. And when enactment is made, it requires to be supplemented in various ways by human mechanism before it can be really effective. Here is one instance. Recently a meeting has been held in the City for the purpose of forming —and so it was resolved—an Association to promote the enforcement of the provisions of an Act that is itself intended to enforce obedience to the ethical obligation of just dealing as between seller and buyer's agent. The ethical obligation has been bound about in the past by legal obligation; but the law was loose and insufficiently stringent to have any sensible effect in restraining that form of corruption and turpitude that has been described expressively, if inelegantly, as the "canker" of commerce. The measure in question is that designed for the prevention of corruption in commercial dealings; and it comes into force on Jan. 1 next. The direction in which the new Association intends to apply its energies is in the giving of publicity to the new Act by meetings, and by impressing its provisions on the attention of all engaged in commercial and professional pursuits, and especially on the attention of public bodies. The Local Government Board have already forwarded a circular-letter to the local governing bodies throughout the Kingdom calling attention to the new Act.

The word "prevention" is used in the title of the Act. The Act, however, not only aims at preventing corrupt practices in commercialism, but it seeks to cure. Short as the measure is, it has been drafted with consummate comprehensiveness, which makes it all-absorbing of individuals and of the methods that give life and effect to this bane of commerce and business relationship, and imposes punishment of that severe character that cannot fail to act in large measure as a deterrent. The old looseness of the law has been tightened up; and many there will be who will now find it very irksome. It cannot be expected that the Act will effect a complete cure; but those who infringe its provisions—those who corruptly offer, those who give, those who accept directly or indirectly—will find they are indulging in an increasingly dangerous operation, with heavy punishments of both imprisonment or fines, sometimes both, attaching to the offence. There is no need to enumerate the evils of bribery and corruption. They are many, and well known; they are destructive of honour and faith as between employee and employer; and they are, to put the matter plainly, nothing short of the meanest of thefts. Corruption and bribery are ever light-winged. Once started they have no abiding place; and their flights are beyond retraction. And those who share in them—those who offer, those who give, those who receive—will assuredly discover that, under the new Act, they are more than ever confiding their reputations, positions, and businesses into other men's hands. As from Jan. 1 next, it will be no use blinking the matter, and trying to feel any sense of security in the old ways; the man doing so will simply be living in a fool's paradise.

The temptation to enrich oneself by a breach of fealty, or to gain business favour by esoteric means through a buyer's servant at the expense of that buyer, is great; and it is because of the yielding to that temptation that there is the necessity for the present Act. Who do the Act bring within its four corners? All servants—from the domestic up to the officials and servants of any master, company, urban authority, or of the Government; and the servants and principals of all firms, companies, or otherwise with whom masters, urban authorities, or the Government do business. Servants and officials in business transactions are "agents." If any agent (says the Act) "corruptly accepts or obtains, "or agrees to accept or *attempts to* obtain, from any person "*for himself or for any other person*, any gift or consideration," &c., or "if any person corruptly gives or agrees to give, or "*offers* any gift or consideration," for forbearing to do, or for having forborne to do, any act in relation to his principal's affairs or business, or for showing, or forbearing to show, favour or disfavour to any person in relation to his principal's affairs or business, or deceiving his principal in respect to any document, receipt, or account, then that person shall be guilty of a misdeamour, and be liable to imprisonment, with or without hard labour, for a term not exceeding two years, or to a fine not exceeding £500, or to both, or on summary conviction to imprisonment, with or without hard labour, for a term not exceeding four months, or to a fine not exceeding £50, or to both such imprisonment and such fine. The expression "consider-"ation" the Act construes to mean "valuable consider-"ation of *any* kind." From this summary of the main provisions, it is seen how completely an agent of a buyer or seller, and the seller himself, will place their future in other men's hands by violating the law. Even the asking for, even the offering of, a gift or consideration, without going any further, brings the person making the request or the person offering within arm's reach of the law; and information by the one or the other will, on conviction, bring punishment and the loss of good name, position, and prospective well-being. If there is completion of the request for, or offering of, a gift or other consideration, it is true that the persons implicated in the transaction cannot give information without endangering themselves. But there is such a thing as a discharged agent, or other aggrieved party, hard pressed on some point or other, who can take secret aggressive steps, and set the ball rolling that will perhaps find its resting-place at the bottom of the abyss over which the reputations of persons hang who indulge in this form of self-enrichment by giving and receiving gifts or valuable consideration "of any kind." There are in the Act safeguards against vexatious actions. A prosecution for an offence under the Act cannot be instituted without the consent of (as the case may be) the English or Irish Attorney-General or Solicitor-General. The Vexatious Indictments Act, 1859, or as amended by any subsequent enactment, is also to apply to offences under the new Act.

The question for each one engaged in business is, Does this Act apply to me? Whatever the business, the employment, or the profession, the answer must be in the affirmative. To transgress, will be to constitute oneself a criminal in the eyes of the law; to be found out, or to be the mark of the informer, will, in all probability result in merited severe punishment. We ask, sincerely, that in the gas industry, voluntary or solicited gifts and consideration between those trading together may cease; and that requests and offers be of those bygones that are best forgotten. To employers in the gas industry we say, let officers and servants be paid fairly according to their merit and worth; so that ill-pay may not be an excuse for criminal and underhand dealings. We know that corruption does exist in the gas industry. Information comes to hand from many, sometimes devious, courses; and proof in certain cases would not be difficult to obtain. What reaches us may, through the same channels, become the knowledge of other people. Men and firms are involved; and they run a grave risk, and the issue for them may be of the sternest. The business is not ours. All that we are concerned in is to do our part towards assuring purity in the commercial life of the industry, in which we have men good and true to their employers, and manufacturing and supplying firms who will not stoop to back-door methods of obtaining and retaining favour. But unfortunately they do not constitute the whole. The supplying firms know the officials and servants of their customers; the officials and servants of the customers know the selling firms. Great discrimination is exercised; and "agents" are rarely wrong. We look to the deterring Act—far-reaching in its application and severe in its punishment—having the salutary effect that all honourable men will desire. It is ardently hoped it will never be our duty to report proceedings under the measure in which any individual or firm connected with the gas industry is concerned.

There are a few words more. The coming into operation of the Act and the simultaneous arrival of the festive season have brought to us the question from two or three

quarters as to how stands the Christmas gift under the new order of things. It is a most difficult question, and one upon which reply can only be in the nature of a personal opinion. The necessity of exercising discrimination as to the officials of customers to whom Christmas gifts are made, the fact that the gifts are in some cases of such value that the term "Christmas Present" becomes a synonym for reward, the fact that individual firms are known to spend many hundreds of pounds—in some cases a thousand pounds and more—in distributing gifts at Christmas time, and the further fact that the practice has reached competitive dimensions between firms (to the greater enrichment of recipients), do not present the custom in the most favourable light. The money thus spent has necessarily to be obtained from the business done; and the spending of it in this way most common-sense men will agree can only be to gain "favour." The box of cigars, some say, is regarded as only an expression of friendship and goodwill; but expression of friendship and goodwill could be equally well conveyed on a Christmas card. The aggregate of the cost of the custom has too much solidity about it for the benevolent interpretation we should like to give to these acts. If the gift, whatever its value, was not intended to gain or retain favour, why need firms—many of whom would be glad of relief from the expense and annoyance of the custom—fear that discontinuance, without the discontinuance was general, would be disastrous to their business? That which they fear to lose is that which the Act says they are not to retain by any gift or consideration of any kind to which there is value attached. Who is to define valuable consideration? To some men, fifty cigars might have great value. Then where can the line be drawn? If it is true that there would be loss of business through discontinuing the custom, firms losing old-standing business would be able to say pretty accurately who among the recipients of their former bounty accepted it within the meaning and spirit of the new Act. There has been a desire on the part of manufacturers in the past to stamp out the custom. The new Act gives the opportunity. How many will avail themselves of it?

## Leeds University and the Professorship of Fuel.

In last week's issue, there were in our "Correspondence" columns two letters bearing upon this subject, one of which—that by Professor Arthur Smithells—had not come to hand at the time the editorial note to other letters was penned. Mr. Thomas Newbigging's letter—in which he gave hearty support to the proposal made by Sir George Livesey the previous week, that a sum of £500 a year should be contributed by the gas industry in support of the new department at Leeds University which is to be dedicated to the study of fuel in its various aspects, and especially of gaseous fuel—requires a little consideration in conjunction with that by Professor Smithells. Mr. Newbigging suggests that "if objection should be raised "to such an endowment of a chair in a special University, "this would be overcome if—following the good example "of Leeds—similar professorships were appointed in the "Universities (say) of Manchester (Victoria), Liverpool, "Birmingham, and London; each of these being adequately "endowed." But this idea appears to clash somewhat with this paragraph in Professor Smithells' letter: "We think "that in this comparatively new work, of teaching applied "science to the highest level, the different Universities may "well each take special lines; and we aspire to be not "merely a local centre, but to draw students from all parts "for the studies in which we may be particularly strong." These two statements clearly invite the expression of a few reflections.

The scheme is one which should be very attractive to the gas industry, for with fuel the manufacturing operations of the industry are commenced—in the retort furnaces, retorts, and boiler-house—and the staple product is fuel, and so is the residual of largest output. If the scheme commends itself as, for the foregoing reason, it ought to do to all in the industry, then the general desire will be that it shall be successful; and we do not think in a special departure of this kind—requiring fairly considerable financial support, special training and ability at the head, and an expensive equipment—there would be such great success by division as suggested by Mr. Newbigging as by centralization as suggested by Professor Smithells. The difficulty of getting any large number of really first-rate students, it seems to us, would also be great; and so, all things considered, division would, in all probability, produce waste and an indifferent success.

In these new ventures in the direction of applied science, each University might very well be allowed to take up its own speciality; for emulation such as Mr. Newbigging speaks of is apt to assume the shape of a mischievous rivalry. As we understand, at the Leeds University, there is a department for dyeing and leather, but not for brewing. Birmingham has brewing, but not dyeing and leather. This specializing seems a very sensible arrangement, and one that should result in the greatest benefit to the students. And there is nothing, for example, to prevent students who have learned their general science at Leeds going to the Birmingham University to learn brewing; nor for students who have learned their general science at Birmingham, going to the Leeds University to study one of the specialities there. Of course, the general sciences must be represented in all Universities, as well as certain branches of applied science—like general engineering and electrical engineering. It may also be that the time is not far distant when fuel may be represented at all the big Universities. Meanwhile, pioneer work has to be done; and it seems to us that for this concentration is essential. We recognize the difficulty of the question raised by Mr. Newbigging. The local Universities have no doubt got what they call local patriotism, or what other people might call, to the extent that the term will apply, parochialism. The question, however, is: Is the Leeds University well suited for this work—are the character of the staff, and the nature of the surroundings, suitable for the purpose in view? When we remember that Professor Smithells is at Leeds, and that Professor Bone is at the head of the new department, we can only answer the question in the affirmative, and ask that the Leeds University may be allowed to make the experiment they have instituted, and receive in it the support of the gas industry to a degree of which, when placed in comparison with other industries, no one associated with our own industry need be ashamed.

## North Sussex Gas and Water Company.

Promoters and directors who rule the drafting of prospectuses adopt a variety of methods to draw the public. Some give a great deal of information about what other companies than the one actually concerned, are doing; others invite the public to look at the prospects, so to speak, through a powerful telescope, which causes an enlargement to the eye but does not bring the object within grasp; others again do not trouble to give any information on which there can be a gauging of probable success. With the last, perhaps it is a case of the least said the better. We have before us a prospectus of the North Sussex Gas and Water Company, inviting applications for an issue at par of £7500 of 6 per cent. preference stock. The document is chiefly remarkable for the reticence displayed on all matters which give hope of the businesses of the supply of gas and water in the district proving successful. There is no information as to the number of houses within the area of supply, no information as to the population, and no information as to the results of any canvass. Even the Directors' names do not assist in filling up the blank paper, and in giving confidence to the public. All these are points that investors look for; but we must say we prefer this kind of moderation to fallacious and fulsome statement. The Company obtained powers in 1905 to construct gas-works. After the Act was passed, the Directors hit upon a new site for the works, and proceeded to construct them. Confirmation of the change was obtained in an Act promoted this year; and water-supply powers were also obtained. The magnitude of the gas-works may be judged by the fact that, after the Act was passed in 1905, and after the change of site was effected, the works were "officially" opened in February last.

### The Applications for Gas Services and Preference Stock.

In the present prospectus, there is no information as to the number of gas consumers connected between February and Oct. 30; and an inquiry as to the quantity of gas supplied during the last six months, elicited the evasive reply that the Secretary was unable to give the information. "The laying on of services (taken in rotation) has," adds the Secretary, "naturally

occupied some considerable time; and therefore any figures supplied would be misleading." The Secretary might have stated the number of connections made; and the number should be one of which the Company ought to be proud, as the "laying on of services has naturally occupied a considerable time." If only one service per working day had been laid on, which would not have been carrying on operations at high pressure, over 200 services would have been connected, between February and Oct. 30. By the way, the Company's prospectuses and correspondence bears the Billingshurst address; the post-mark is London. The name of one of the Directors is precisely that of one of the Directors of the Laindon and District Gaslight, Coke, and Water Company, Limited, whose prospectus did not receive favourable notice in the "JOURNAL." Of course, the Director in question cannot help the similarity. However, the Directors of the North Sussex Company have learned that this is not a particularly good time to ask for capital for Companies that are not well established, and that do not (to borrow a phrase from a recent correspondent) show a satisfying quantity of "meat upon the plate." Six per cent. is a tempting rate of interest for preference stock; but even so it did not bring in applications to cover the £7500 by 12 o'clock on Tuesday, Nov. 13, "not later" than which time and date the Directors were prepared to receive applications at par. This statement is made on the authority of the Secretary, for that gentleman was writing on Nov. 16 expressing the pleasure he would have in learning whether a correspondent desired to "secure" an allotment, as the Directors were meeting the following Friday to consider further applications. This is very wrong of them, as they were, according to the prospectus, only prepared to receive applications "not later" than the time and date mentioned above. Is it strange to have to say the correspondent did not desire, and so did not "kindly fill up" the form enclosed? Apparently there are many more like him.

## The Thermal and Hygienic Value of Gas-Fires.

In another part of the "JOURNAL" will be found some extracts from a long report by the Coal Smoke Abatement Society on a series of experiments carried out for them by Dr. Owens, Assoc.M.Inst.C.E., under the superintendence of Dr. H. A. Des Vœux. The full text of the report, which is accompanied by elaborate tabulated particulars in regard to the tests, as well as by several diagrams, is published in the current number of "The Lancet," to which we must refer those of our readers who desire more ample details than those we present. We, however, reproduce the table containing particulars respecting eight of the best stoves tested, and give, practically in its entirety, the third part of the report, which consists of an interesting general consideration of the results of the tests, and a comparison between gas and coal fires. The tests were made in rooms situated (on the same floor) round a court in the new Public Offices at Westminster; each room being of about 4000 cubic feet capacity. The conditions were exceptionally favourable for making fair tests, inasmuch as they were alike for all the stoves. There were 25 different makes selected, and they were tested with the view of finding out, first, their thermal efficiency, considered as appliances for heating the air of rooms; and, secondly, their effect on the air thus heated, regarded from a hygienic point of view. The conclusions drawn from the tests are that a properly constructed gas-stove, provided with a flue sufficiently large to carry away the products of combustion, is quite as satisfactory hygienically as a coal fire, though for constant work it is more costly. One point specially favourable to the gas-stove is emphasized: It does not in any way vitiate the air of the room in which it is used, nor does it produce any abnormal drying effect, as is popularly supposed; while its capacity to carry off from 2000 to 4000 cubic feet of air per hour renders it a very valuable ventilator. It was only in the very largest gas-stoves, however, that the calorific value of the fuel burnt per hour approached that obtained with coal; being in the majority of cases about one-third. But against this must be placed the fact that while gas-fires usually produced a fairly steady temperature in from one to two hours, the coal-stoves took much longer. This is a point in favour of gas-fires; and another is that they can be easily regulated, and the heat of the room controlled in a way which is not possible when coal is the fuel used. It is the letting out and relighting which makes the coal-fire wasteful; whereas gas can be lighted and turned off as required without causing unnecessary waste. Moreover, the reporters are of opinion "that a properly constructed gas-fire has the advantage over a coal-fire from a hygienic point of view, owing to the more equable temperature, and the absence of dust and smoke." While credit is given to flueless condensing gas-stoves for being economical, they require certain conditions, which are indicated, in order to make them absolutely satisfactory in operation. The report, which contains much valuable information, concludes with some suggested improvements in the construction of gas-stoves and in the character of the fuel used in them, to which doubtless attention will be given in the proper quarters.

## Mr. James Swinburne on Indoor Illuminants.

The Association of Engineers-in-Charge, at their meeting last Wednesday, had Mr. James Swinburne chatting on all sorts of matters associated with the utilization of gas and electricity, under a title which should have limited him to "Indoor illuminants." Mr. Swinburne, it is obvious, sadly wants a rest, though things would be a bit dull occasionally without him. He seems to have completely exhausted himself on the subject of his paper. What he had to say has all been heard from him before. Banter, homely truths concerning illumination, antiquated notions, and omissions are all discoverable in the paper by those who care to read it. Heating by gas and electricity, flame arc lights, and gas engines and electric motors all found place among the "indoor illuminants;" but high-pressure and other high-power gas lighting and inverted gas-lamps large and small escaped Mr. Swinburne's attention. He gave the common form of incandescent burner its due—of being capable of producing an illuminating power of 20 candles per cubic foot of gas per hour; but to save his reputation among his electrical friends, he accused gas of using up the air and causing other inconveniences and injury. Mr. Swinburne's knowledge of these things wants modernizing a little more. He has correct information as to the illumination that can be obtained by the incandescent burner; but he passes by the facts that one incandescent burner, consuming 3 or 4 cubic feet of gas displaces several flat-flame burners, and reduces the consumption of gas by numerous cubic feet, in relation to the candle power. By such ways, a vast improvement has been effected in other directions than that of illuminating power.

## Amicable Relations at Southampton.

In view of the fact that it is not unusual for gas companies to have good reason to complain of the hostile attitude adopted towards them by local authorities, it is gratifying to read the remarks made by Captain A. J. Corse Scott, J.P., the Chairman of the Southampton Gas Company, at the recent half-yearly meeting. The Company were in Parliament last session with a Bill to enable them to raise more money and to free them from the now notorious sulphur restrictions; and the only opponents were the Corporation, from whom the Directors received the fullest courtesy and consideration. On their part, the Board, of course, were only too anxious to avoid the expenditure of a large sum of money on a fight in the Committee-rooms; and a conference between the parties was held. The result of this was that, by the granting of some concessions on both sides, the Bill passed as an unopposed measure; and the cost to the Company was less than one-quarter of the £4000 that they had to pay for their previous Bill which was opposed. This is satisfactory enough; but it is not all. The Company were threatened by the Guardians with that familiar trouble of gas undertakings—an "increased assessment." The Company recognized that their growing prosperity justified the authorities in expecting a larger amount from them in the shape of rates; but they disagreed with the Guardians as to the extent to which the assessment should be raised. Here, again, the authorities were reasonable; and an agreement was arrived at between the parties, by which the assessment was increased by a considerable sum, though much less than was originally claimed. The shareholders in the Company, the consumers, and the ratepayers generally have good reason to congratulate themselves on the amicable settlement that was thus arrived at with regard to two matters that might otherwise have involved the expenditure of a large amount of money; and all parties should be—and no doubt are—grateful to the Directors and the representatives of the town for the successful manner in which the negotiations were carried through.

## Dr. Grossmann on Chemical Developments in Gas-Works.

The Manchester Juniors may consider themselves fortunate in being the channel through which the highly interesting lecture of Dr. J. Grossmann on "Modern Chemical Developments in the Dry Distillation of Coal" has derived publication. As a chemist, Dr. Grossmann is a great believer in his own sphere of science—its works and its issues; and in reading his lecture one falls almost into the same vein as the lecturer, and begins to look forward to the time when the gas-works will become converted into a chemical manufactory, and the gas be looked upon as a secondary product. But after getting free from the lecturer's influence, we feel very much inclined to challenge him on this point. It is true that progress is introducing more and more chemical complications into gas-works; and the gas engineer needs to be more and more of the chemist if he would be complete master of the operations at his works. There are many points in Dr. Grossmann's lecture that will be found profitable to look into. There is the part of the lecture which leads up to the suggestion of advantage accruing from the storing of gas liquors for a long time by the increase in the yield of ammonia; and there is much advanced that will be useful to the student and the uninitiated on the question of the recovery of cyanogen compounds, though this is a line of recovery that has lost some of its attractions in the great reduction that has taken place in the market value of ferrocyanides during the last ten years. The question of the influence of cyanogen compounds on sulphur recovery is also dealt with.

## Treating Effluents of Sulphate of Ammonia Manufacture.

Placed among the complications that have been introduced into gas-works is the treatment that has become necessary in so many places of the gaseous and liquid effluents produced in the working up of sulphate of ammonia, owing to the mischievous influence that the admission of the untreated effluent, if passed into the sewers, has upon the bacterial treatment of sewage, or owing to the objection of river authorities to the untreated effluents passing into streams. It is more than the "open question" as Dr. Grossmann calls it, as to whether the sulphocyanides and phenoloid bodies do injuriously interfere with the bacterial treatment of sewage; it is an ascertained fact. We have shown recently how relief has been obtained by gas-works by a patented system of purifying the effluents. Dr. Grossmann, in the lecture, presents us with a method of dealing with the effluents that is designed to *completely obviate their admission either into sewers or streams*. His process involves the utilization of part of the liquor in the scrubbers, the evaporation of another part, and from the residue the removal of the ammonium chloride. This is not all; but it indicates the main part of the system. The most serious business about it appears to be the evaporation part of the process. But Dr. Grossmann has, he tells us, invented a cheap and effective method of accomplishing this. The process described is attractive in the margin of profit it holds out upon its working. By a second and simplified process (also patented), which does not involve any alteration of the present mode of working, and is introduced almost without any extra cost of plant, Dr. Grossmann opens to view a pleasant prospect—the elimination of nearly all the troublesome sulphocyanide from the liquors, the removal at the same time of the ferrocyanide, and an extra profit of about 8s. per ton of sulphate obtained! We should like to see this process practically tested; and with the trouble that sulphate of ammonia makers in parts are now experiencing, engineers are bound to be attracted by it. If Dr. Grossmann is not taking a too rosy view of the capabilities of his child, there should be in store a great success.

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On the occasion of the opening of the new railway bridge and sidings for the Smethwick Gas-Works on Wednesday last, an account of which is given elsewhere, Mr. W. J. Sturgess, the Secretary of the Gas Department, was congratulated on having completed twenty-five years' service in connection with it.

Mr. Richard Whitaker, of St. Anne's-on-the-Sea, who was one of the Directors of the Gas Company, has bequeathed £10,000 out of the £44,910 he left at his death on the 15th of September last, for the provision of almshouses and scholarships for Rawtenstall, of which borough he was a freeman. There are to be two scholarships of £50 each and two of £25 each, tenable for three years, for poor boys and girls.

# GAS STOCK AND SHARE MARKET.

**(For Stock and Share List, see p. 560.)**

THINGS on the Stock Exchange showed a decided improvement. Not that a roaring trade was being done; for the expansion of fresh business was to an extent repressed by the settlement of a long and heavy account. But there was manifestly an improved tone in pretty well every department; and buyers were conspicuous in the markets. Naturally enough, possible sellers held on to their stocks in view of this; so that at last there was quite a shortage where not long ago free offers to sell met with no response. Consols on Saturday not only touched, but topped, 87—a figure they had long been a stranger to. It was the Money Market that wielded the magic wand. The 7 per cent. Bank Rate bogey was driven off, if not killed; and a brilliant vista leading to a monetary Palace of Gold was opened up. So the week closed happily, with a well-maintained rise. In the Gas Market, it was the quietest week since the deadest slack time of the autumn holidays; and on some days about six or eight transactions were the sum-total of the markings. There was thus not much scope for varying quotations; but what few were effected were almost all in the upward directions, and the exceptions were assignable to exceptional causes. In Gaslight and Coke issues, the ordinary was very lightly touched, and did not present any salient feature. Transactions opened on Monday at 99 and 98¼; and for the remainder of the week, all the dealings marked were at or between these figures. The secured issues were proportionately just as quiet as the ordinary. The maximum was done at 89⅛; the preference at 107½ and 108⅝; and the debenture was not dealt in at all. South Metropolitan was the only issue of any importance which was well up to the mark in point of activity. The opening bargain on Monday was at 127½; and 128½ was marked on Saturday. The debenture stock also had several transactions; and prices ranged from 84½ to 85¾, with a tendency to advance. Commercials were very quiet. No business was recorded in the 4 per cent.; the 3½ per cent. was done at 108⅛ and 110; and the debenture at 85½. The Suburban and Provincial group were little dealt in; but it may be noted that at the Mart a large parcel of an issue not quoted on the Exchange was sold at a good price. Brentford old was done at 260 special; ditto new at 200½; British at 41 and 41¼; Bromley "A" at 124½; Wandsworth debenture at 84; and West Ham debenture at 104½. Bromley "B" rose 1; and Wandsworth "B" rose 2 without being dealt in. In the local Exchange, Liverpool "A" fell 1. The Continental Companies were again very quiet. Imperial marked 186½ and 187½ *cum div.*, and 182½ *ex div.* Union was done at 127⅞ and 126½; and European fully-paid at 25. Among the undertakings of the remoter world, Buenos Ayres changed hands at 11⅞; Primitiva ordinary at from 7⅛ to 7¾; ditto preference at 5½; ditto debenture at 97½; River Plate at 12 1/16 and 12⅛; ditto debenture at 97 and 97½; Ottoman at 6⅛; Cape Town at 14½; and Melbourne 4½ per cent. at 101¾. Oriental rose 1.

The closing prices are shown in our Stock and Share List on page 560.

# ELECTRIC LIGHTING MEMORANDA.

**The London Boroughs and the London County Council Scheme—An Electricity Company and Competing Borough Electricity Supplies—Renewals and Depreciation—Depleting Reserves at Bradford—Public Lighting Controversy at Bristol—The "Electrician's" Assumptions.**

WHAT does London think of the County Council electricity scheme? That is an important question; and the laconic answer seems to be "Not much." The only opportunity the ratepayers will have of expressing approval or disapproval of the scheme will be, by their votes, at the County Council elections next March; but it will not be put before them in any definite form. The "Daily Telegraph," however, has, through its local representatives, been "feeling the pulse" of the ratepayers on the question in the different boroughs; and if the reports faithfully mirror opinion, the County Council scheme is not going to be willingly shouldered by the ratepayers. Seemingly it is largely a matter of party politics. The Moderates or Municipal Reformers are now dominant in the local Councils; and their view is that it is better "to bear those ills we have, than fly to others that we know not of." As the Municipal Reformers were the other week put into charge of local adminstration by the revulsion of feeling that Progressive mismanagement has brought to pass, it may be taken that the views of the Municipal Reformers on this question of committing the ratepayers to a project involving millions are those of the ratepayers generally. Most of the Borough Councils are likely to petition against the County Council measure in the name of the ratepayers. In those boroughs where there are not municipal electricity stations, the Municipal Reformers say kindly words as to existing private enterprise sufficing. On the other hand, the Progressives are not all of one mind over the scheme. In those boroughs where there are not municipal electricity stations, the Progressives (with their wonted love for the extravagant) are prepared to confide everything, even to the uttermost parts of the earth, to their soul-inspiring and beloved County Council. But among Progressives

in boroughs with electricity undertakings, there is a division of opinion as to the scheme; and the influence of local circumstances again asserts itself. Among the Progressives are those who do not like the County Council wolfing their pet lambs in the way proposed; while there is another party among them who look with a little glee on the prospect of the shifting from the Borough Councils to the County Council of the millstone of financial responsibility that the electricity undertakings have put about the necks of the ratepayers. Among the more wily of the Progressives, their recent rout suggests that the present is an inopportune time for the County Council to move. With them we are in agreement, and hope that the condition will be a perpetual one. But speaking generally, the common views are that the County Council ought not to be trusted with further trading powers, that they have forfeited the confidence of the ratepayers, that the scheme is a reckless and speculative one, that the visions of the projectors are never likely to assume reality, that a heavy burden will fall upon the ratepayers, and that supply by Companies, without involving the ratepayers in risk, is all-sufficient for London. The condition of things looks hopeful for an uprising against the scheme that has been manufactured with the broadness of spirit that exists at Spring Gardens, stretched to its utmost by those who sit in authority in Whitehall Gardens. Let the ratepayers remember that these municipal fanatics have no care whether the electricity scheme is popular or not. It is a furtherance of the Progressive policy, and that is enough. That policy must be maintained inviolate—no matter the cost, no matter who is injured thereby.

It may be expected, now that the Municipal Reformers are in power in the boroughs, that there will be a vigorous overhauling of the accounts of electricity departments, that all charges will henceforth be properly made against the undertaking, and that the annual statements will be so framed as to be an unchallengable presentment of the financial position. It has borne hardly on all ratepayers, private and industrial, that bad management should have been accompanied by corrupt accountancy. There are very few Borough Councils running electricity concerns that can claim a clean record. Among the ratepayers in South London who suffer, and who are engaged in industrial pursuits, are the London Electric Supply Corporation, Limited; and they have long complained of the hardship imposed upon them as competitors of the Bermondsey and Southwark Councils. Some months ago, the Corporation wrote to the Local Government Board, pointing out the unfairness of the competition to which they (as a statutory concern) were exposed, through having to aid their competitor through the rates, and contribute to the losses incurred. The Managing-Director (Mr. R. S. Bain) has returned to the charge, and has called the attention of the Board to the still graver state of affairs disclosed by the last accounts of the two Councils in which they are concerned, and to the evasion of the Bermondsey clause by Bermondsey. If the accounts of this particular authority were amended as Mr. Bain suggests they should be, a total loss of £4332 on last year's working would be shown, instead of a profit of £3660. The expenses he alleges as being under-charged are: Dust destructor, £3562; rates and taxes, £627; law and parliamentary charges, £559; depreciation, reserve, or sinking fund, £2114. Adding to these items revenue over-credited for supply to the public lamps, £1130, and the total amounts to £7992. This readjustment would cause the expenses to be increased to £15,449; and the revenue reduced to £15,363. This shows a loss of £86, to which has to be added interest on mortgage debt and loans, £4246; making the before-mentioned £4332. With regard to Southwark, the expenses undercharged are: Rates and taxes, £467; parliamentary charges, £559; depreciation or reserve, £1478. Add to these items the revenue over-credited for supply to the public lamps, £960, and we have a total of £3464. In this way, the year's expenses are increased to £11,771; and the income decreased to £12,386—showing a balance of £615. As the interest on, and repayment of, loans for the year amounted to £4659, Mr. Bain maintains there is a loss on the year's working, if the accounts had been properly prepared, of £4044, instead of a profit of £379. The whole of this loss must be borne by the ratepayers. In addition, Mr. Bain contends that the amount charged for administration expenses is inadequate. Whether the Local Government Board will take any action on Mr. Bain's letter has yet to be seen. Meanwhile it is exceedingly interesting to notice that the immaculate London County Council, through the Finance Committee, have been chiding the Islington Borough Council regarding their reserve fund, which has, it turns out, only a paper existence. The accounts for the last financial year showed a balance to the account of £14,139; but this is not represented by cash or investments, but only by book debts and stores. This, as the Committee have pointed out, is not an effective or satisfactory reserve fund. Under the new local *régime*, it is hoped that false accountancy will soon be extinct, so that the ratepayers may know the whole truth concerning municipal trading in this most hazardous of businesses.

The Presidential Address of Mr. Charles Wood to the Institution of Gas Engineers last June stirs up interest in the accounts of the Bradford Corporation Electricity Department. It is an undertaking that has had, in its later years, a chequered career; and it is certain the enemies of depreciation and reserve funds in municipal ventures will not quote Bradford in support of this particular tenet of theirs. The Bradford undertaking is one of those that has for some time been feeling the effect of the infirmities of age, and the weight of a capital of about £706,000. It has, as Alderman D. Wade nicely put it recently in the Council, suffered reverses peculiar to the character of the undertaking, due largely to unforeseen developments with other considerations outside the control of the Committee, which have handicapped it somewhat in its progress towards financial success. This is worth looking into as an illustration of the necessity of having ample funds in hand in connection with electricity concerns. At the beginning of the year, these accounts showed a balance of unappropriated profit, together with a renewal fund, of £40,447. The income for the year was £98,095; and the working expenses £47,062—leaving £51,033. Interest and sinking fund absorbed £47,048; giving a balance of £3985 to be added to the reserve fund, and making it £44,432. Against this a sum of £17,244 was required for renewals during the year; hired motors and arc lamps had had to be written down to the extent of £7925; and marine boilers, &c., had had to be depreciated by £5670. Deducting these items from £44,432, there is only £13,593 remaining, compared with £40,447 at the commencement of the financial year. This is not as things should be; but the Electricity Committee hold that it is all beyond their control. So it may be; but it is an all too common occurrence for municipal electricity concerns to get beyond the control of those who manage them.

Since the Local Government Board inquiry in Bristol, the ratepayers have been buzzing with (for the Corporation Electricity Department) uncomfortable vigour round the question of the relative costs of incandescent gas lighting and electricity for street illumination—the unfortunate attitude of Alderman Pearson, at that inquiry and since, having done more to excite interest than could anything else. With ineffable loftiness, he disdains to consider whether street lighting can be done as efficiently and more cheaply by gas than by electric lighting; but the ratepayers, judging by numerous letters in the local papers, obviously are more concerned over the matter than is the Alderman who was elected to assist in administering local affairs with economy, but has "missed his way" so far as the public lighting goes. Many of the ratepayers have been trying to instil into the darkened mind of the Chairman of the Electricity Committee, that, as the providers of the money spent on public lighting, they have different views from his own; and they want to learn whether they are getting the best possible value for their money. Alderman Pearson has not, in response to the invitations, come into the open, nor has the Electrical Engineer; but the Town Clerk has been cutting a poor figure by trying the effect of a few generalities in disposing of a very direct case of mismanagement of the public lighting that Mr. John Phillips, the Secretary of the Bristol Gas Company, has put forward in the local papers. His letter appeared in the "JOURNAL" a fortnight since, and there have been other copyings into our columns of matter published locally—all showing the intense interest that exists in the subject. There was a practical directness about Mr. Phillips's letter, and to sum up the main points, he showed that the electric lamps that have displaced 1200 gas-lamps were costing the ratepayers £9000 more than would efficient incandescent gas lighting. Against capital account there is also a charge of nearly £14,000 in respect of the arc lamps. The ratepayers are in a quandary regarding the advantage they have been gaining by the continuation of this extravagantly costly light. Figures have also been quoted showing that the Corporation have been guilty of letting slip very favourable offers from the Gas Company for illuminating the streets, and purposely so, with the object of benefiting the electricity undertaking. They shied at one condition suggested by the Gas Company in connection with the provision of improved street lamps and lighting, that, on the discontinuance of any of the gas-lamps, the Council should pay the Company £1 1s. per lamp; and then went and dissipated the ratepayers' money in another direction. The excuse for the rejection of the Company's offer looks paltry when set alongside the £9000 a year that is now being wasted on electric lighting that is not profiting the city in any way above what gas lighting would do. Another offer by the Gas Company, made on a certain condition of things, was withdrawn by them on learning that the Corporation were going to still further relieve them of a portion of the street lighting and give it to the electricity undertaking. The Company cannot really be blamed for this. It is hard enough for them as ratepayers to have to pay part of the price of expensive lighting; but all through the piece their offers for the improvement of the street lighting have been ill-rewarded by the Corporation. Now the Electricity Department are rejoicing over having public lighting costing the citizens £672 and £435 per mile of street. These prices far exceed the cost of electric lighting in London streets, and yet the ratepayers in the Metropolis are very properly grumbling. In connection with this cost per mile of street for lighting, some figures have been published in Bristol; and prices of £73 to £91 have been quoted as being the charges of Electricity Companies in London for public lighting. That is a mistake. These prices refer to the cost of incandescent gas lighting per mile of street.

Our contemporary the "Electrician" attempts to reprove us this week for entertaining views that Mr. George Wilkinson and other electricians hold regarding lighting charges being "*frequently* too high while power charges are *certainly often* too low." These words appear in Mr. Wilkinson's presidential address to the Leeds Section of the Institution of Electrical Engineers, and were alluded to in last week's "Memoranda."

The "Electrician" admits that there may be "isolated cases" where Mr. Wilkinson's assertion may be true. "Isolated cases" have not a corresponding significance to "frequently" and "certainly often;" so that, if our contemporary has cause of quarrel they may be referred to Mr. Wilkinson and to Mr. W. B. Esson, who was also quoted last week. The "Electrician" also indulges in a little unfriendly kick in this connection, by saying: "It is perfectly evident that our contemporary is absolutely at sea regarding the principles involved in formulating a tariff." True the principles involved in formulating electrical tariffs are fearfully and wonderfully formed; but really our contemporary does itself a downright injustice. For (apart from other means of obtaining experience of these things) no one could have been a regular reader of the "Electrician" for a course of years from the days of universal flat-rates without learning all there is to be known about the formulation of electricity tariffs. Still our contemporary may take unto itself all the joy that is to be obtained from unadulterated assumption, which assumption, there is clear evidence, is carried into further remarks dealing with incandescent gas-burners. Says our contemporary:

> Of course, it is all very well to tell a man to look at an incandescent gas mantle, and think it is giving 80-candle power. Perhaps it does so at first, if the conditions are very favourable; but that happy state of affairs is all too brief, and anyone who has had experience with incandescent gas-burners in the photometer-room will know that the falling off in illuminating power is remarkably rapid, especially when the mantle begins to go to pieces. Another serious matter is the effect which slight variations of pressure have upon the much-prized "inverted" burners. As a matter of fact, it is very difficult indeed to determine their candle-power to within 5 per cent., unless special and elaborate precautions are taken.

Now, we should like to know if there is a member of our contemporary's permanent staff who, in the photometer room, has had the experience of "rapid" deterioration of incandescent gas burners and mantles stated here. Some time ago, an offer was made to our journalistic friends to prove to any one of them who is also a photometrist that such writers are "absolutely at sea" regarding the brevity of the maintenance of the illuminating power of incandescent gas-burners, on the one condition that there should be a faithful account published in the electrical paper concerned of the observations made. Not one of our electrical journalistic friends jumped at the offer. Of course, a little allowance must be made for their flights of imagination, owing to their sensitiveness as to references to the diminution of lighting power and other (for the consumer) unpleasant idiosyncrasies of electric lamps. We have heard, and have had experience, of variations of voltage badly affecting electric lamps. Of course, both among electricity and gas consumers there are the negligent; but it is not fair to utilize their negligence to depreciate a competitor.

## The Chemical Trade of England and Germany.

At a recent meeting of the Liverpool Section of the Society of Chemical Industry, Dr. James T. Conroy, B.Sc., delivered an address in which he compared the chemical trade of England and Germany. For this purpose he tabulated the exports and imports in various chemicals for the two years 1895 and 1905; these periods being chosen as furnishing the latest available information as to our present trade. In preparing the table, he followed the German system of classification, where the various materials are grouped into two divisions—viz., raw and manufactured articles. Among the latter are pitch, tar, and tar products; and in dealing with them Dr. Conroy made the following remarks: "The group comprising coal-tar derivatives—such as benzol, anthracene, naphthalene, &c.—requires notice, emphasizing as it does the complaints recently made by Sir George Livesey as to the unsatisfactory conditions of the English tar market. Our loss here is considerable, and is largely owing to the fact that Germany is now able to supply from its own gas-works and coke-ovens much of the raw material necessary in the aniline colour industry. It may further be noted that Germany is drawing continually increasing quantities of its imports in these products from Austria-Hungary. This competition has not only hit us as regards quantity, but it has also had a most disastrous effect upon prices. Thus, the average price for light oils imported into Germany is now only £10 per ton, as against £22 10s. in 1895, and £30 to £31 in the two succeeding years. It is worthy of special note that Germany has now developed a considerable export trade in these oils, and that whereas ten years ago and earlier their export price was well below the import price, it is now some 25 per cent. higher. The German imports of anthracene have also fallen to one-fifth to one-quarter of the 1895-9 figures. In the case of naphthalene, however, a large increase is to be noted. This is probably due to the development of the artificial indigo industry, but not entirely so. The exports of naphthalene now reach nearly 3000 tons, and for years past the export price has been almost double that of the import. In both instances, the better prices obtained for the export article are probably due to a greater purity of product; and our tar distillers might find it worth their while to look further into this question." In his concluding remarks, Dr. Conroy pointed out that the development of the coking industry abroad had considerably reduced our outlet for tar products, and had, by greatly increasing the foreign output of coal-tar oils, anthracene, &c., produced obstacles which we can hardly expect to overcome.

# OBITUARY.

### JOHN RICHARDSON WIGHAM.

It is with much regret that we record the death on Friday last, at his residence, Albany House, Monkstown, County Dublin, of Mr. John Richardson Wigham, whose name will be remembered by many of our readers in connection with his efforts for the improvement of lighthouse illumination by means of gas. Since the serious illness which attacked him at the time of the last meeting, a few years ago, of the British Association in Belfast, for which he had prepared a paper, he had been practically a chronic invalid. From the first, little or no hope was entertained of his recovery; and he passed away at the advanced age of 78.

The late Mr. Wigham was of Scotch extraction, and was born in one of the suburbs of Edinburgh. He received his education in that city, and in early life removed to Dublin, where he entered the establishment of his brother-in-law, Mr. Joshua Edmundson, who carried on a large hardware and manufacturing business. On the death of Mr. Edmundson, Mr. Wigham, while still very young, was called upon to take entire control of the concern. At this time, gas lighting was superseding oil and candles in Dublin; and Mr. Wigham immediately set about developing the system of fitting which his brother-in-law had introduced. He gave much attention to the improvement of the design and manufacture of small gas-works suitable for lighting public institutions and private houses; and eventually he conceived a plan for the use of the illuminant produced in them. His conspicuous ability was quickly recognized, and among other appointments conferred upon him was that of Engineer to the then Commercial Gas Company of Ireland; one of the first large contracts he carried out for the Company being the designing of the gas-works at Kingstown.

In 1865 Mr. Wigham devised a system of applying gas to lighthouses, which had previously had to depend upon less satisfactory means of illumination; and the utility of his invention, by means of which the gas was manufactured on the spot, very quickly brought him into prominence, and gained for him the gratitude of all engaged in shipping affairs. The new illuminant was adopted by the Commissioners of Irish Lights, and the Bailey Lighthouse at Howth, just outside Dublin, where it was first installed, very soon attested the merits of the invention. Mariners spoke so favourably of it that the Commissioners employed the late Professor Tyndall to report on the invention. The opinion of this distinguished scientist was so favourable to Mr. Wigham's system, that it was adopted in nine of the principal lighthouses in Ireland and two in England. Mr. Wigham made still further improvements, with the result that public attention was largely directed to the matter; and the question of the general adoption of the gas system was referred by the Government of the day to a Committee of the Trinity House specially chosen, and called the Lighthouse Illuminants Committee. It consisted of Sir Sydney Webb (the Master), Captains Nisbet, Weller, Burne, and Goyan, Sir James Douglass (the Engineer), Mr. J. Inglis (the Secretary), and Mr. Price Edwards, with Mr. Harold B. Dixon, M.A., as the Secretary. The whole question, as some of our readers may remember, was thoroughly investigated—an exhaustive series of experiments being carried out at the South Foreland. Full particulars of them were given in our columns at the time, in articles contributed by Mr. Dixon. The conclusions of the Committee were not particularly favourable to an extension of the gas system; and a strong controversy took place on the merits of this system, which was defended by Professor Tyndall with all his vigour. He was then the Scientific Adviser to the Board of Trade, of which Mr. Joseph Chamberlain was President; and such was the friction between them, that it led to the Professor's resignation. However, the investigation and the controversy only strengthened the opinion of those who had had any practical experience of Mr. Wigham's method of lighthouse illumination, that it was one of great utility.

It is unnecessary to refer in detail to the various improvements effected by Mr. Wigham in burners, lamps, and other appliances for gas and oil lighting. One of his latest patents was for an ingenious system for ensuring the steady and continuous illumination of buoys and beacons round the coast. He was tireless in his efforts on behalf of those who "go down to the sea in ships and do their business in the great waters." He was the inventor of several kinds of fog signals and sirens which are now in general use; and his name and works will be long remembered by all engaged in maritime affairs. In addition to his inventive faculty, he possessed thorough business capacity. Some years ago, a branch house was established in London, which was originally intended as an offshoot of the Dublin establishment. But so rapid was the development of the business that it was taken over by a separate Company, under the title of Edmundson's Electricity Corporation; and Mr. Wigham became Chairman. At the same time he did not sever his connection with gas, as he was a Director of the Alliance and Dublin Consumers' Gas Company. He was also a Director and Vice-Chairman of the Dublin United Tramways Company. For a time he was the Chairman of the Blackrock Town Commissioners; and on the dissolution of that Board and the formation of the Urban District Council, the ratepayers again showed their confidence in him by returning him as a member of the newly-constituted body. He was a member of the Chamber of Commerce, and held office as Hon. Secretary. So highly was he esteemed among the members, that some years

ago they elected him President. The Royal Dublin Society was an institution in which he took much interest; and his experience and business capacity were always gladly placed at the disposal of the Council. He was a Justice of the Peace for the County of Dublin, a member of the Royal Irish Academy, and an associate member of the Institution of Civil Engineers. He read papers before the British Association, the Royal Dublin Society, the Society of Arts, and both the London and Dublin Institutions of Civil Engineers. Our columns have from time to time contained communications from him; his last—on "A New Flashing Lighthouse Light"—having appeared about four years ago.

Public recognition of Mr. Wigham's services as a citizen as well as a scientist was by no means lacking. In this connection, it may be mentioned that in the first Jubilee year (1887) he was offered a knighthood—an honour which it was generally thought he richly deserved. However, as a member of the Society of Friends, he did not see his way to accept the offer. "His action in this matter," says the "Irish Times"—to which source we must acknowledge our indebtedness for some of the particulars of Mr. Wigham's lifework here presented—"was but another instance of his innate modesty, and, if possible, made him more beloved among all who valued his transparent honesty of purpose and his upright, honourable character." His death will, we are sure, cause widespread regret; and the utmost sympathy will be felt with the family in their great bereavement.

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We regret to record the recent death, at the age of 68, after a severe illness, of Mr. Evan Jones, the Manager and Secretary of the Aberdare Consumers' Gas Company—a position that he had filled almost from the commencement of the undertaking. He took a keen interest in all public matters in the town, and was P.M. of the St. David's Lodge of Freemasons. It will be seen from our advertisement columns that the Directors are taking steps to appoint a successor.

By the death of Mr. William Allison, of Louth, a link has been removed from an interesting chain of service in connection with the Louth Gas Company. The deceased gentleman was a Director of the Company for 57 years; his father was the first Secretary and subsequently a Director. His brother (Mr. T. F. Allison) was Secretary for more than 50 years; and his nephew (Mr. Philip Allison) is now acting in the same capacity. At a recent meeting of the Directors, a resolution of sympathy with the relatives was passed.

News reached us yesterday afternoon from Mr. T. Berridge, of the death, on Sunday evening, at Kenilworth, at an advanced age, of Mrs. Heard, on whose behalf a subscription was raised about eight years ago through the medium of the "Journal." The deceased lady, it may be remembered, was the widow of Mr. Edward Heard, who was associated with Winsor in establishing gas in London. A sum of £37 was subscribed, with offers of more money should it be needed; and when a second appeal was made early in 1903, a total of £46 was quickly forthcoming.

The death occurred on Sunday, the 11th inst., at the age of 82, of Mr. J. Devonshire Ellis, the Chairman of John Brown and Co., Limited, of Sheffield. Deceased was engaged in the production of steel before the discovery of the Bessemer process, and was the first person, outside the inventor's own firm, to adopt it. Two years ago, on attaining his 80th birthday and the jubilee of his management, he resigned the position but consented to continue the Chairman of the Board. He is survived by six children. One of his sons, Mr. C. E. Ellis, is Managing-Director of the Company, and another, Mr. W. H. Ellis, is associated with the internal management of the Atlas Works.

## PERSONAL.

The Directors of the Market Rasen New Lighting Company, Limited, have appointed Mr. J. Green their Manager, in succession to his father, Mr. Charles Green, who died on the 6th ult, at the age of 62, and who had held the position for fourteen years.

Mr. Albert R. Cawley has resigned the position of Manager to the Rhymney and Aber Valleys Gas and Water Company, which he has held since 1902. Previous to that, it will be remembered, he was for some years Manager and Secretary to the Llanelly Gas Company.

**Scottish Junior Gas Association (Western District).**—Next Saturday, the members of the Association will visit the Earnock Colliery, and we are asked by the Hon. Secretary (Mr. G. Braidwood, of Dawsholm) to notify that those who join the party will be afforded an opportunity of inspecting the underground workings.

**The Assistant Engineership at Bristol.**—In the "Journal" for the 23rd ult., there appeared an announcement that the Directors of the Bristol Gas Company were about to appoint an Assistant-Engineer. It will be seen from our advertisement columns today that the selection has been made; and we learn that Mr. Preston, the Superintendent of the Company's Stapleton works, has obtained the position.

## NEW BUSINESS METHODS.

In a beautifully printed and illustrated volume, we have before us the work of the Editor, Mr. George Williams, of the "Report of the New Business Methods to the American Gas Institute." The Editor, we need no word to tell us after reading several parts of his book, brings business methods to bear on the compilation; for he lays under tribute all gas men in the States from near and far, and, in the volume, does the contributors justice by excellent work and illustration, and so ensures their future support. The age has no compare in the history of gas utilization as one that needs all the commercial aptitude that can be brought to bear in extending and defending the gas business; and therefore it can be readily understood that this plan of collecting ideas, derived from the ingenuity and experience of numerous progressive men, is immensely appreciated by the gas suppliers. It makes available a large diversity of opinion from which to select and give trial; but discretion must always be exercised as to what is best for one's own particular circumstances. The volume extends to 308 pages, divided into eight parts—viz., (1) Short editorials, (2) methods, (3) newspaper advertising, (4) mail and miscellaneous advertising, (5) coke, (6) demonstrations, (7) sale-rooms, and (8) examples of good advertising.

The "editorials" are by different writers; each taking a distinct subject. The first very appropriately is on new business discrimination. "Discrimination!" A long discourse could be built up upon this word in connection with business. It is a quality that is of the essentials to success. Here we have, next in order, an article on the effect of good service upon gas sales. A uniform quality of gas—more especially in respect of calorific power—is insisted upon as a necessity, and constancy of pressure throughout the twenty-four hours is advocated. With the changes that day consumption has brought about, a nearer approach to constancy in pressure can be indulged in throughout the twenty-four hours—at all events, the variation between day and night pressures need not be so large as formerly. But where there should be constancy is not so much throughout the twenty-four hours as through the hours of daylight on the one hand, and through the hours of darkness on the other. For heating and cooking, if the pressure is too high, there is a proneness to waste on the part of the consumer, unless fires and cookers are fitted with quite modern means of regulating the gas and air supply. With such methods of regulation, if universally applied, and the distribution system sound, as it ought to be, constancy of pressure would be feasible. With these qualifications, we can endorse the views of the author as to the effect of good service upon gas sales. The same writer also urges the importance of adjusting consumers' appliances so as to obtain the utmost efficiency from them. The cultivation of the friendship of local newspapers and of advertising in them is the theme of another writer. Later in the book are several specimens of advertisements from many sources. Then an article is perused with interest on obtaining business and holding it. Getting into personal contact with consumers, through good "solicitors"—who are born, not made—is recommended. While able to expatiate on the conveniences of gas, a canvasser must not misrepresent. Ranges must be sold at cost, connected; and from the very first, consumers should be taught how to use them. The want of knowledge may lead to waste; waste to the loss of the consumer. Attend to complaints quickly is sage advice; and let the consumers understand that the whole object of the gas purveyor is to satisfy, not to rob. An article on "The General Manager" urges the necessity of a man of energy and character for conducting the commercial part of the gas business. Such a man must be given plenty of rein. The advantage of correspondence in developing business is dwelt upon in another contribution; and the "follow-up" system of letters is advocated. The expression is self-explanatory. Shortly stated, the idea is not to lose a customer through neglect to send another letter if the first one fails to bring a reply or further inquiry.

In New York, we read that the rental system for gas-ranges has had a marvellous effect in building up business. The writer is Mr. W. J. Clark. One method is the making of a systematic canvass of all new buildings. A special man is kept at the "Real Estate Records;" and all projected buildings come directly under his supervision. The builder, owner, or agent is followed up, and the advantages of the rental system are explained. A "blanket lease" is taken, embracing the entire range equipment for the building or block of buildings, and involving 10 to 100 or more ranges. The ranges are installed as soon as the buildings are ready. The hauling to the building is done by the Company; the connecting by the builder, under the Company's inspection and approval. The installation costs are kept at the minimum by handling the entire equipment at one time; and the initial outlay to the owner is so low as to preclude the installation of a coal equipment. As soon as tenants take possession, a corps of women demonstrators visit the apartments, look after the final adjustments for efficiency, and instruct in the careful and intelligent use of the appliance. The rental plant is visted periodically by the women demonstrators; and any inefficiency which they cannot correct is reported to the shops, and the regular stove mechanics take it up. The visits of the inspectors keep the Company in touch with the consumers, and promote good feeling. There is also a general canvass by canvassers who are paid

a commission. All other known means of propagating knowledge of gas—such as literature, advertising in newspapers and on hoardings—are resorted to. Where flat-flame burners are in use, and the Company succeed in getting them superseded by incandescents, they also try to retain somewhere about the old consumption by having a cooker installed. Result for the consumer increased illumination, and an additional convenience; for the Company, the retention of the old sale of gas. There is an article in the book on the question of securing the co-operation of dealers in the placing of gas-ranges and other appliances somewhat after the manner of co-operation between ironmongers and gas authorities in this country. Low prices for obtaining power business are also advocated.

The review of these business methods could be carried to columns; but we must refrain. What has been said, however, shows the vast range of matter contained in the volume—matter suggestive, and methods not all novel, but tried and useful; and we congratulate the Editor on the compilation.

## SOURCES OF THORIA IN CEYLON.

In a report by Professor Wyndham R. Dunstan, F.R.S., the Director of the Imperial Institute, issued last week, on the results of the mineral survey of Ceylon in the year 1904-5, he says the most important matter in connection with the examination of the minerals collected during the course of the survey, as well as of others sent by commercial firms in the colony and in England, has been the revelation of the existence of a number of rare earths new to the island, many of which are remarkable for containing thoria and other rare earths, often in very considerable quantity. Besides the new mineral thorianite, which has become an important commercial material, described in a previous report, a number of other minerals have been identified, which may also prove to be valuable as sources of thoria. Among these may be mentioned monazite, thorite, zirkelite, and tscheffkinite. Monazite is now recorded for the first time as occurring in Ceylon, and is exceptional in being richer in thoria than the monazite of Brazil and the United States. Besides the occurrence of this mineral in fragments, Professor Dunstan says it has been found in the sand of certain river beds in which it is associated with thorianite and with gold. The wide distribution of the thoria in Ceylon is the most important result recorded in the present report, and is a fact which may have further commercial consequences when the greater search for the minerals containing it has been made, and the extent of their occurrence has been ascertained. The results so far obtained point to the probability that dredging the river beds for minerals containing thoria, as well as for the gold which sometimes occurs with them, may be a profitable undertaking.

Professor Dunstan reports that the search for thorianite has been fairly successful, and several tons have been collected and sold, often at the satisfactory price of £1600 to £1700 a ton. In the year 1905, about 9 tons of thorianite were exported. The Institute has assisted both the Goverument of Ceylon and the individual firms in the matter of identifying the mineral, and in valuing and arranging for the sale of the consignments received in this country. In the previous report, it was pointed out that the commercial value of this mineral depends on the large amount of thoria it contains. This substance is at present essential for the manufacture of gas-mantles; but it must be remembered by those in Ceylon who are interested in the commercial utilization of the material, that this is the only known use for it. The discovery of large quantities of a thoria-bearing mineral elsewhere would therefore mean a fall in the value of Ceylon thorianite; while the supersession of the mantle, or the discovery of some other material answering the purposes of thoria, might also very seriously reduce the value of thorianite. Professor Dunstan points out that the market value of thoria, which is chiefly obtained from the monazite sands of Brazil, is controlled by a Syndicate who have lately found it desirable to reduce the market price to about one-half of that which ruled during last year; and this has involved a corresponding reduction in the commercial value of thorianite. He therefore thinks it desirable to draw attention to the somewhat precarious nature of commercial dealings in thorianite and other thorium minerals at a time when their exploitation in Ceylon has proved so profitable as it has been during the past two years.

One consignment contained two specimens of thorite. Two pieces of the first, which may be called A and B, and one of the second, C, were analyzed, and the results compared with those obtained on the analysis of a specimen previously reported upon, which may be called D. The following were the results:—

| | A. | B. | C. | D. |
|---|---|---|---|---|
| Thoria, per cent.. | 70·53 | 71·04 | 71·68 | 66·26 |
| Ceria ,, . | 1·45 | 1·89 | 2·06 | 7·18 |

Professor Dunstan says the composition of these Ceylon thorites differs from the specimens of the mineral previously analyzed (which have nearly all been obtained from Norway), in containing much less silica, lime, and water, and more iron and phosphoric oxide. The Ceylon mineral contains more thoria than the specimens of thorite hitherto analyzed, with the exception of the Norwegian variety known as orangite, which contains approximately 72 per cent. of this oxide. Norwegian thorite is supposed to be the product of the alteration of an anhydrous silicate of thorium ($ThO_2SiO_2$) which resembles zircon in form and appearance. The Ceylon specimens are also clearly alteration products. Some have a roughly tetragonal form, while others are apparently derived from a monoclinic mineral.

Two samples of supposed thorite in another consignment were found to consist of monazite, which proved to be remarkably rich in thoria. It contained nearly 10 per cent. of this oxide, in place of the 5 to 6 per cent. usually found in monazites from other sources. A number of the "concentrates" received from the Director of the Mineral Survey have also been found to contain monazite as well as thorianite and gold. Professor Dunstan therefore thinks there is reason to believe that monazite may be somewhat widely distributed in Ceylon, and he considers that information on the point should be obtained.

Thorianite was found in varying quantities in a large number of the samples received from commercial firms. In all cases where the mineral was present in quantity sufficient to be worth working, a portion of the sample was submitted to chemical manufacturers for valuation, and the results communicated to the firms sending the samples. In this way a number of Ceylon firms have been enabled to dispose of consignments of thorianite to manufacturers in the United Kingdom. One of the samples received, from the Galle district, consisted of unusually large crystals, differing somewhat in composition from ordinary thorianite in containing less thoria and more uranium oxides.

A paper dealing with the composition of this material has been communicated to the Royal Society by Professor Dunstan and Mr. B. M. Jones.

## GAS SUPPLY PRESSURES.

By T. Ebenezer Pye, F.C.S., of Chichester.

Mr. Norton H. Humphrys has, I think, once more rendered the gas industry a good service, by his article on the above subject appearing in the last issue of the "Journal." It was with some concern and considerable astonishment that I recently read in your columns Mr. Grafton's remarks as to high district pressures, and more particularly as to small-bore supply-pipes; and I felt at the time that—with all due respect to Mr. Grafton—the wide publication of such opinions as he gave utterance to would not be conducive to the best interests either of the consumer of gas or the producer. The average gas manager of the Provinces, superintending an annual output of (say) from 20 to 200 million cubic feet, is usually responsible for the manufacturing department as well as for distribution; and I can well imagine the absolute dismay with which such a man would view a general acceptance of Mr. Grafton's dictum that to meet present-day requirements the district pressures must be from 4 to 6 inches—"it should not be less than 4 inches." Such dismay would probably, however, be tempered with amusement at the further instruction to lay on ⅜-inch supply-pipes for the gas-cookers.

What would the general adoption of such a doctrine lead to? As Mr. Humphrys points out, the present-day means of gas pressure control are totally unfitted and unequal to meet the requirements which would thus be imposed on the gas manager. There are very few (if any) comparatively small or average sized works to-day from which a pressure of 4 inches, or even 3 inches, can be uniformly maintained. The manager would thus be compelled to introduce costly mechanical and artificial means for forcing the gas through the mains, with all those risks of accident, breakdown, and interference with the uniformity of the supply which must be incident to the employment of such plant.

I would suggest that the following, at least, must result from such a proposed change.

*First.*—By the introduction of the pressure-raising machinery, coal gas will, for the reason just stated, be at one fell swoop robbed of its greatest charm, its chief advantage over all competitors—viz., that feeling of security now enjoyed by all consumers, which is due to the constancy and reliability of gas supply under present-day conditions.

*Second.*—The installation of the new plant will entail a heavy initial expenditure, which must be paid for by the consumer, as also the repair and maintenance of the machinery. A revenue charge further handicaps gas in these days of competition, which possibly has been overlooked.

*Third.*—Increased cost of repair and maintenance of distribution system. Also, in spite of this, there will be heavier leakage. Both of these items will be paid for ultimately in the price of gas—a still further handicap for gas.

*Fourth.*—Manufacturers of gas heating, cooking, and power apparatus, &c., would, of course, re-adjust all their new patterns of burners to meet these new conditions.

If I remember aright, it was the late Mr. Thomas Fletcher who first addressed himself to practically apply scientific principles to the manufacture of gas heating-stoves in bulk for general public use, and constructed his burners according to theoretically correct designs. Mr. Fletcher, I believe, based all his calculations upon an assumed gas pressure of *ten-tenths of an inch only*; and I think I am right in stating that the gas cookers, fires, &c., of his firm were therefore so adjusted as to yield their highest available duty, per foot of gas burned, when the gas was being used *at*

1 *inch pressure*. Repeated tests have revealed that, for heat given per foot of gas burned, this pressure resulted in the best efficiencies. This rule may not apply now; but I have not heard that it has been abandoned by the firm named. Gas-engines have for years past been sent out so fitted as to work at their highest efficiencies with gas at from 12-10ths to 15-10ths pressure. The Welsbach "C" burner was for many years, and I think is now, sent out so adjusted as to be at its best under a pressure of from 10-10ths to 12-10ths of an inch—a fact which most people have approximately proved for themselves by the simple expedient of turning down their gas-control taps in order to increase the light obtained from the burner. The general re-adjustment of all coal-gas consuming apparatus to suit a pressure three or four times that for which they were made, would be impracticable; while the introduction of all new apparatus, constructed only to suit the proposed fresh conditions, would lead to no end of confusion. Dissatisfaction would, and must, become rife; and our friends the electricians, or other of our competitors, could hardly wish for a worse state of things for gas supply than would soon result from any serious attempt to universally apply Mr. Grafton's new doctrine.

I like to consider myself a Junior in the profession, and to be able to sit at the feet of the prophets and learn wisdom. But in this matter I must say that—as has been testified by the columns of the "JOURNAL" for years past—the gas consumer, his aspirations, his difficulties, and his relations with the supply undertaking, have to me been a subject of fascinating interest and close study. As a result, I, like Mr. Grafton, have arrived at conclusions as to what is good for the consumer; and here we must join issue. As already shown, my own conclusions, based on years of observation and close contact with the consumer, are the very converse of what I understand to be the gist of Mr. Grafton's advice to the members of the London and Southern District Junior Gas Association; and I can only hope that his hearers will not too blindly follow his lead. We are most of us truly working at "high pressures"—too high for efficiency—and at too great a pace for our comfort. Let us see to it that we are not too readily led away by this great rush of modern times. I am glad that we have the older and wiser heads still among us to give stability to our opinions, and to steady us in our march and actions. So I look back to Mr. Newbigging's advice first given over thirty years ago, and repeated up to the present day, and which has never yet been improved upon: "A Golden Rule for Gas Managers.—Keep down your pressures."

Consistently with that modicum of common sense which bears in mind all necessary requirements of to-day, the application of this rule will even now lead to golden results in dividends saved as well as in dividends earned. The conditions of gas supply to-day are truly different from those of twenty years ago; but the difference is all in our favour, tending, as it does, to the maintenance of a day load approximating much more closely to that of the lighting hours, and thus favouring the admitted *desideratum* of a more uniform pressure throughout the 24 hours. Excessive pressures are, under certain circumstances, unavoidable, and are only for this reason tolerated by many engineers; but I maintain that, given a reasonably good supply system about the consumer's premises, such as the gas company should put in (I mean with pipes throughout the premises of ample size—by far the cheapest system in the long run), a pressure on the meter outlet, or outlet of the governor if there be one, of 15-10ths to 16-10ths of an inch is ample. If this be not so, either the pipes are too small or choked, or the fittings are defective.

I have always impressed upon the consumer the advantage of burning gas at as low a pressure as will give him satisfaction—*i.e.*, flat flames burning quietly, ordinary incandescents turned down until they give the maximum of light, Kerns and inverteds according to requirements, and boiling-burner flames not to mount the sides of the vessel they are heating. As a student, I was taught that chemical reactions are not assisted by violent hurry, and that combustion under ordinary atmospheric conditions and not artificially assisted (as with a blowpipe), to be perfect, must not be rushed. The consumers at Chichester are therefore told, among other things, that unpleasant smells from lighting burners are due to imperfect combustion, which most probably arises from too much gas, as well as from dust and dirt, and that smells from boiling-burners may arise from the same causes or from dirty vessels being thrust into the flame. They are shown how to remedy this. Up to now, the pressure at the cooker not being less than (say) 12-10ths of an inch, we certainly have not advised a material increase of gas-pressure to the burner-tip as a remedy for the trouble.

But Mr. Grafton very clearly indicates that this is all wrong. If he can show us, from years of practical experience among the consumers, that this is so, and if he can further, as a chemist, give scientific reasons (which will apply to the practical every-day conditions of the ordinary consumer) proving that the best remedy for an evil-smelling flat-flame or bunsen burner is to very materially increase the gas-pressure behind it, we shall, I am sure, be very pleased to hear from him again.

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The London and Southern District Junior Gas Association will next Saturday pay a visit to the Kensington Show-Rooms of the Gaslight and Coke Company. After the inspection, tea will be provided, at the conclusion of which Mr. F. W. Goodenough will address the members.

## POSITION OF INCANDESCENT LIGHTING.

By Professor DREHSCHMIDT, of Berlin.

(*Concluded from* p. 467.)

The diagrams already given show the results of the individual testings of illumination and the distances of the lamps from one another; and from these data the average illumination afforded, both of horizontal and vertical surfaces, on the roadway and footway, has been computed, with the following results:—

| Method of Lighting and Situation. | Millennium Light. Alexander-strasse. | Arc Light. Leipziger-strasse. | Flame Arc Light. Bellevue-strasse. | Inverted Gas-Light. Invaliden-strasse. |
|---|---|---|---|---|
| | Cb. Ft. | K.W. | K.W. | Cb. Ft. |
| Rate of consumption } Cubic feet or kilowatts per hour | 169½ | 0·825 | 0·660 | 32·2 (8 burners) |
| Illumination in "lux"— | | | | |
| Horizontal surface, roadway | 10·3 | 7·4 | 8·5 | 3·1 |
| Vertical ,, ,, | 12·0 | 3·4 | 1·6 | 4·1* / 4·8† |
| Horizontal ,, footway | 20·7 | 5·6 | 2·8 | 9 4 |
| Vertical ,, ,, | 15·1 | 3·0 | 1·3* / 2·2† | 5·0* / 7·2† |

* Surface at right angles to direction of street.
† ,, parallel ,, ,,

From these figures, and particular prices for gas and current, the cost of an average illumination of one lux, on the vertical or horizontal surface, in the middle of either the roadway or the footway, may be calculated for the different modes of lighting. It should suffice to know the illumination on these two lines of measurement, because if it is adequate on both, it will also be adequate over the intervening space.

Dr. Bloch, in the comparison of the cost of gas and electric lighting for streets, to which reference has already been made, took chiefly Berlin conditions, and only the net costs of gas and current, without subsidiary charges. By taking current and gas at the price of 12 pfennige (1·44d.) per kilowatt and cubic metre respectively (for gas = 3s. 4⅜d. per 1000 cubic feet), calculating the mean illumination in the incorrect fashion previously mentioned, and ignoring the illumination of vertical surfaces altogether, Dr. Bloch has made out electric lighting to be 36 per cent. cheaper than gas for the same illuminating value. But the price taken for current is lower than that charged in Berlin, even for supplies for power, in the day time mainly, and very much less than the lowest rate (32 pfennige = 3·8d. per kilowatt) charged to large consumers for lighting purposes. Actually the net charge for current supplied for public lighting from the municipal electricity works is stated at 12·5 pfennige (1·5d.) per kilowatt, and this does not cover the cost of attending to, and repairing, the public lamps, &c., amortization, depreciation, interest charges, and other items included in the price of gas. The cost of gas from the municipal gas undertaking of Berlin, on the same basis as the foregoing rate of charge for current for public lighting, would be 4·667 pfennige per cubic metre (1s. 3·86d. per 1000 cubic feet). At this, or even a considerably higher, price for gas, and the equivalent 1·5d. per kilowatt for current, the inverted gas-light is incomparably cheaper per lux than electric lighting, or even than the Millennium gas-light, in respect of either the illumination of horizontal surfaces in either direction, or vertical surfaces at right angles or parallel to the direction of the street. Flame arc lighting is by far the dearest of the modes of public lighting considered, and the Millennium gas-light is much cheaper than ordinary arc lighting in all points, except for the illumination of a horizontal surface at the side of the lamps.

It becomes apparent from the comparison that the present position of incandescent gas lighting leaves no ground for fear that it cannot compete successfully with other modes of lighting, and as further improvements may be expected as much in gas as in electric lighting, the competition should continue into the far future. The Lighting Committee of Berlin has evidently taken this view, for they decided a short time ago upon a very comprehensive extension of street lighting by means of high-pressure gas. The length of streets and open spaces in Berlin lighted by this means up to the present has been about 6120 yards, served by 361 lamps; but in a short time it will have increased to about 27,115 yards, with 1363 high-pressure lamps.

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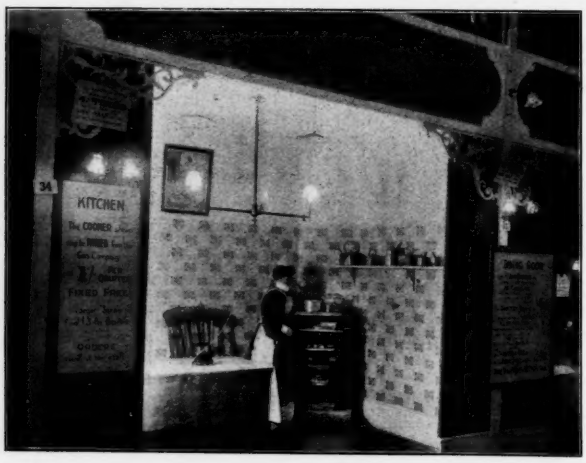
We learn from the Engineering Supplement to "The Times" that the Directors of the Barrow Steel Company have determined to put down an installation of gas-engines to provide the blast for their iron-smelting furnaces, and they propose to utilize the waste gases from these to propel their engines. The difficulties which have stood in the way of the utilization of blast-furnace gases as motive force have gradually been overcome. Means of purifying the gases have been discovered, and it has been found possible to build gas-engines of enormous power to be utilized in connection with blowing plant. By the adoption of this principle, the Company will, it is believed, be able to effect great economy in the production of iron.

## A GAS DISPLAY AT PLYMOUTH.

A DESCRIPTION appeared in last week's "JOURNAL" (p. 476) of the successful display of the use and advantages of gas for lighting and other purposes that was made by the Plymouth and Stonehouse Gas Company at the West of England Manufacturing and Industrial Exhibition, which has lately been held in the town. It was stated that the Company had on their stands fitted up two compartments as a dining-room and kitchen; and another




**The Gas Company's Rooms at the Plymouth Manufacturing and Industrial Exhibition.**

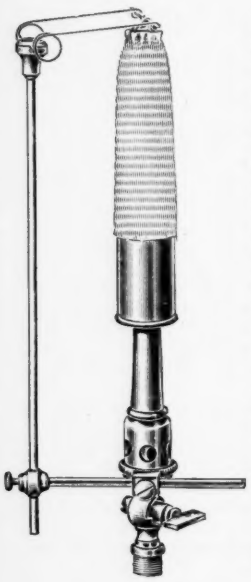
exhibit was a Crossley 3 H. P. gas-engine. The attractive arrangement of these stands will be clearly seen from the accompanying three illustrations, which have been reproduced from photographs sent by Mr. P. S. Hoyte, the Engineer of the Company.

The dining-room is lighted, as will be noticed, by a gasalier fitted with six inverted incandescent burners, giving a light equal to 112 candles. Allowing for four hours' burning per night, the cost per quarter of this, with gas at 1s. 9d. per 1000 cubic feet, would be 4s. 10d.; while it is stated that, to secure an equal light with electricity, would need 152 units, the cost of which, at 3¾d. per unit, would be £2 7s. 6d. This is a difference of more than nine to one in favour of gas.

Turning to the general view, it will be noticed that, at intervals along the top of the front of the stalls, beneath the Welsbach self-intensifying lamps, there are fitted electric glow lamps. Unfortunately, it was found impossible to have these lit during the exposure; but doubtless had it been otherwise, the light given by them would have fully borne out the statement placed by the Gas Company under each one of them, and above the inverted gas-burners. Reduced as our illustrations of necessity are from the original photographs, the wording of the notice referred to is not clear; but we may say that it is as follows: "The two gas-burners below are giving four-and-a-half times as much light and at one-half the cost of the electric lamp above."

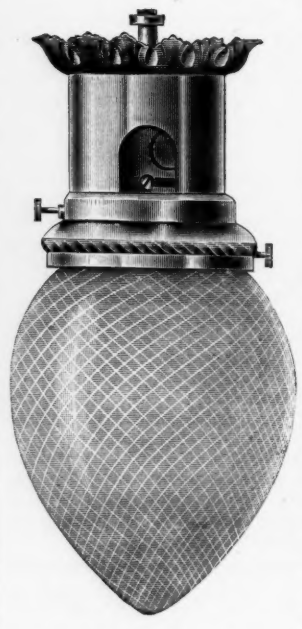
## THE "WHITBY" ANTI-VIBRATOR.

Those who have to place incandescent mantles in such positions that it is necessary to protect them from the injurious results of vibration, will be interested in a novel form of appliance introduced by Messrs. J. & W. B. Smith, of Nos. 19-23, Farringdon Road, which they have named the "Whitby" patent anti-vibrator. The accompanying illustration so clearly explains the idea that no description at all of the arrangement is necessary. It may, however, be pointed out that it is applicable to all ordinary incandescent burners, whether for indoor or outdoor purposes. It will be seen that the use of the appliance allows of the position of the mantle being adjusted so that it can be lowered if the base breaks or wears; while the mantle can also be readily removed and replaced to allow of the cleaning of the burner. It is claimed that the anti-vibrator has proved satisfactory under the most severe tests; and that when used with it a mantle will last longer under vibration than any mantle carried by a prop or rod. The simplicity of the arrangement will be obvious to anyone who glances at the illustration; and its efficiency is highly spoken of by at any rate one gas engineer who has tested it.



## THE "LIAIS" REGENERATIVE GAS-LAMP.

Having passed through many stages of improvement, which have been patented in all the principal countries where gas is used, these burners and lamps are now being placed on the market by the "Liais" Light, Limited, of No. 117-118, Long Acre, manufactured in such substantial forms that they should prove their value. As now made, the burner-tube, the mantle-supports, and the mixing and heating chamber, are all cast in one solid piece of metal, which adds greatly to their strength. The air, which is brought into the mixing-chamber, is regulated by a new device, as will be seen from the illustration. By turning the upper part of the burner casing (kept cool with asbestos packing), the orifices for the admission of the air supply are partially closed. Upon the exact proportion of air being admitted to form the mixture suitable for the pressure of the normal gas supply, the regulation can be set by screws arranged for the purpose. On the mixture of gas and air being heated, the regenerative action is at once seen to take effect, and the light increases about 15 per cent. The mantle is encircled by a glass cylinder, and is protected from shaking by being firmly attached to the burner.



# THE SOUTHERN DISTRICT ASSOCIATION'S NAPHTHALENE INQUIRY.

## HISTORY OF THE INVESTIGATION,

**Presented by the Committee at the Meeting of the Association last Thursday.**

THE time has now arrived when, through lack of funds, this Association has reluctantly to relinquish its endeavour to solve the naphthalene difficulty—a task upon which it has been engaged during the past five years or so—especially in view of the fact that considerable progress has been made. Your Committee, therefore, consider that it is due to the members of the Association, and to the Directors of those companies who have so kindly subscribed to the fund raised for the purpose, that they should present a report setting forth the objects they had in view in undertaking the research, and the various steps which have been taken in the direction of bringing about the hoped-for result.

The matter was first discussed at a meeting of the Committee held on Oct. 9, 1901, when the following resolution was passed:

> That a Sub-Committee be appointed to consider and report in what manner the facilities for investigation possessed by the Association can be best employed to determine questions relating to the formation and deposition of naphthalene.

At the same meeting a Sub-Committee was appointed to carry this into effect.

The first meeting of this Sub-Committee was held on the 17th of October of the same year; and the first step taken was to decide the best way of securing the necessary funds for carrying on the work of research. After some discussion, it was resolved to issue a circular to all gas companies represented by the Association; giving particulars of the proposals of the Committee, and appealing for subscriptions towards the expenses which would be incurred.* At the same time it was fully recognized that it would be hopeless to anticipate a successful issue unless the carrying out of the necessary investigations were entrusted to a properly qualified and expert chemist. After careful consideration, the Sub-Committee arrived at the conclusion that Dr. Harold Colman, who possessed all the necessary qualifications, should be appointed to the position. This view was afterwards endorsed both by the full Committee and by the members; and it may at once be said that they have never had cause to repent their decision.

In response to the appeal for subscriptions which was issued on Feb. 24, 1902, a fund was slowly raised which, by November, 1903, amounted to £398.

In October, 1902, a further circular was sent out, requesting answers to certain questions dealing with the subject which were appended to the circular, with a view to their being formulated in such a way as to secure information from all available sources within the Association's district. In response, some 88 of these circulars were returned, filled up more or less completely. The replies were tabulated and carefully considered by Dr. Colman, who in February, 1903, presented a full report to the Sub-Committee, in which he discussed the information received, drew certain conclusions therefrom, and made recommendations as to the methods of investigation. This report was summarized, and presented to the members on the 19th of March of the same year.† At this meeting, a formal resolution was carried approving the action of the Committee, and empowering them to proceed in the manner which seemed best to them.

In accordance with the recommendations of their adviser, the Committee selected six gas-works, referred to in the report as A, B, C, D, E, and F, at which further investigations should be carried out. At the first three of these works, no trouble was experienced from naphthalene; while at the other three, considerable separation of this hydrocarbon took place, either at the works or in the district, or in both. Dr. Colman at once commenced his investigations, and in October, 1903, presented a report to the Sub-Committee giving particulars of his experiments, which had so far principally been devoted to ascertaining the conditions existing at the above works, both with regard to the quantities of naphthalene present in the gas, and the amount of condensable vapours, other than naphthalene, which were contained therein. Experiments were also made with the view of securing similar information with regard to the carburetted water gas made at some of the works in question. This report was summarized in the annual report of the Committee which was presented to the members on Nov. 12, 1903.‡

For some time experiments were continued on similar lines; and in February, 1904, Dr. Colman presented a comprehensive statement detailing his experiments up to date, which was laid before the members on the 17th of March of that year.§ A long discussion followed, in which various useful suggestions were made, and approval was expressed of the work being done by the Committee and their adviser.

During the year investigations were continued. But at a meeting of the Committee held on Oct. 20, 1904, when Dr. Colman gave particulars of the progress of his work, it was pointed out that the funds at the disposal of the Committee were more than exhausted; and it was therefore decided to ask him to draw up a full statement of the work he had so far done. Upon receipt of this, the Committee presented a report which, accompanied by a statement of accounts, and including an appeal for assistance towards providing the funds necessary to enable the Committee to proceed with their investigations, was considered at a well-attended meeting of the members held at the Earl's Court Gas Exhibition on Nov. 24, 1904.* A very long discussion followed, in which, among other suggestions, it was proposed that an appeal for assistance should be made to the Institution of Gas Engineers. Finally, it was decided to approve of the recommendation of the Committee that the report, &c., should be circulated, but to confine the appeal to the District Associations. This resolution was carried into effect on the 12th of the following month; the result being that a further sum of £193 was received from 22 undertakings, several of which, it may be said, had already subscribed in answer to the first appeal. No favourable response was, however, received from the District Associations.

Some little time prior to this date, the notice of the Committee had been called by their adviser to certain results which had been obtained at a works near London by extracting the heavy tars from the gas while hot by means of a "Cyclone" tar extractor, and then allowing the gas to pass on into the condenser in the presence of the remaining light oils, which were very active in absorbing napthalene. At the same time at Works F a series of trials was made with a view to ascertaining the result of adding the vapours of light hydrocarbons to the gas as it was passing through the condensers. These vapours were introduced at different points in the condensers and in varying quantities. These results were so promising, that Dr. Colman was requested to continue his experiments in this direction as far as funds would allow; and this he was enabled to do, owing in no small degree to the kindness of the Directors of the gas-works in question.

From time to time Dr. Colman communicated his results to the Committee, and finally advised that the most promising direction in which to pursue the inquiry was to deal with the gas according to the methods indicated above. At the same time he stated that, in order to obtain reliable data, it would be necessary to erect, at some works where trouble was experienced, a condenser large enough to deal with a considerable proportion of the gas as it left the retort-house under ordinary working conditions. As stated, however, it was found impossible to proceed on account of lack of funds; and as the appeal which was made at the time failed to bring in a sufficient sum, another circular, accompanied by a statement of receipts and expenditure, was sent out on April 4, 1905, and this resulted in an additional sum of £105 being received. The Committee felt that, with the small sum at their disposal, it was quite impossible for them to continue their researches in as complete a manner as they had hoped. Fortunately, however, the Directors of the Gaslight and Coke Company and their Engineer, Mr. T. Goulden, came to their assistance by offering the Committee certain facilities for carrying on the work at their Silvertown station. Here a "Cyclone" was erected, and a series of experiments were carried on. The results obtained, though of extreme interest, are not so conclusive as could be wished, for the reason that, these works being used primarily for coal testing, the variety of coal was altered every few days. Particulars of these experiments, and of the conclusions arrived at in connection with them, will be found in the final report of Dr. Colman, which the Committee now have pleasure in submitting to the members. [See Appendix.]

The Committee appreciate the fact that their work is incomplete, and has not achieved the results which they hoped to attain. They trust, however, the investigation has not been unfruitful, and that it has thrown light on many obscure points in connection with the subject, thereby rendering assistance to others who, working with the same objects in view, but possibly on dissimilar lines, have benefited the industry by their investigations and by the processes they have devised for mitigating the evil, and whose results have in turn been of assistance to the Sub-Committee in their further work. They also trust that the result of their labours will be to assist others, who may carry on the work to a successful conclusion.

The main object of the inquiry was to ascertain if it were possible to rearrange or alter the working of the ordinary plant of a gas-works, so as to effect the automatic and regular removal of the naphthalene in the usual course of the manufacture, and thereby avoid the necessity of special subsequent treatment. With this end in view, the Committee began by studying the conditions existing at various works as to the cooling and condensing of the gas, and the effects produced thereby on the naphthalene and other vapours contained therein. They hoped in this way to discover a method by which the gas could, with certainty, be completely deprived of its naphthalene by the time it left the

* See "JOURNAL," Vol. LXXIX., p. 628. † *Ibid.*, Vol. LXXXI., p. 767.
‡ *Ibid.*, Vol. LXXXIV., p. 411. § *Ibid.*, Vol. LXXXV., p. 766.

* *Ibid.*, Vol. LXXXVIII., p. 692.

condensers, under all varying conditions prevailing in different works; or, if this should not be found possible, to arrange the condensation so that the gas should carry forward sufficient vapours of light hydrocarbons, other than naphthalene, which would combine with the naphthalene and precipitate it in a liquid instead of in a solid form. The Committee greatly regret that, although much valuable and interesting work has been done, the investigation has been stopped, through lack of funds, before these aims have been accomplished.

In conclusion, they desire to express their high appreciation of the great assistance rendered by Dr. Colman, whose zeal and enthusiasm throughout the investigation deserve their hearty recognition. The Committee desire also to thank the Gas Companies who so kindly contributed to the funds; also the Directors of those Companies who afforded facilities at their works for carrying out the experiments, and the Engineers and their Assistants at those works for the valuable assistance they so willingly rendered.

*London, Oct.* 25, 1906.

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[Appendix.]

## DR. COLMAN'S FINAL REPORT.

Chemical Laboratory,
1, Arundel Street, Strand, W.C.,
*Oct.* 1, 1906.

To the Naphthalene Sub-Committee,
Southern District Association of Gas Managers.

Gentlemen,—In submitting my further report in connection with the naphthalene inquiry, it will be convenient to refer shortly to the general results obtained up to Feb. 29, 1904, which were given in previous reports.

It will be remembered that investigation had been carried on at six different works, three of which were troubled with naphthalene deposits in the works or district, while the other three had practical immunity from trouble. As a result of the investigation, it was found that the immunity of the latter works was not due to the fact that the gas contained less naphthalene than was the case at the other three works, as the amount found was often greater in the works where no stoppages occurred. It was, however, ascertained that the gas at the last-named works contained a decidedly higher quantity of the vapours of liquid hydrocarbons, &c., having boiling points lower than naphthalene, in particular of those liquids whose boiling-points more nearly approached that of naphthalene (mainly xylenes, cumenes, and phenol), and that the freedom from trouble in these works was probably due chiefly to this cause, as in case of any naphthalene being deposited from such gas by cooling, it would be accompanied by a sufficient quantity of light oils to dissolve the naphthalene, so that the deposit would be liquid and not solid, and would flow to the syphons without causing further trouble. These results confirmed the views already put forward by Bunte ("Journal für Gasbeleuchtung," 1892, p. 569), Young and Glover (Transactions of the Gas Institute, 1897, p. 113, and 1900, p. 144),* Eitner ("Journal für Gasbeleuchtung," 1899, p. 73),† and subsequently by others.

Investigation was then made as to the cause of the presence of higher quantities of light-oil vapours in the gas at the works untroubled with naphthalene, which might be due either to (1) more light oils being produced in the carbonization of the coals under the conditions prevailing at those works, so that a larger quantity was always present in the condensers during the process of cooling; or to (2) special conditions of condensation being present at those works, resulting in a larger proportion of light oils being retained in the gas and less in the tar.

The amount of light-oil vapours present in the gas was estimated in the following manner: Green anthracene oil was distilled until the thermometer in the vapour showed a temperature of 270° C. and the residual oil, after separating any solid crystals deposited on cooling, placed in a train of wash-bottles. About 100 cubic feet of the gas to be examined was then passed through these bottles at a rate not exceeding 1 cubic foot per hour; the oil being then again distilled until the thermometer in the vapour reached 270° C. The distillate thus obtained was carefully fractionated, using a long Le Bel-Henniger fractionating column, and measuring the fractions collected between 100-130° C. (chiefly toluene with some benzene and xylene), and between 130-170° C. (chiefly xylenes, cumenes, and phenol). This method does not give the amount of such vapours with absolute accuracy; but as all the fractionations were carried out in the same apparatus, and the rate of distillation kept the same as far as practicable, the results afford a fair comparison of the quantities present in the different gases. It was not found advisable to continue the fractionation beyond 170° C., as the distillates above this temperature contained considerable quantities of naphthalene.

The determinations made of the light oils in the gas and in the tar at each of the six works showed that, in fact, a much larger amount of light oils was produced at the works free from naphthalene stoppages. Further it was found that at two of the works free from trouble, special conditions existed in the condensing plant which might have the effect of increasing the proportion of light oils retained by the gas. In one case, the whole of the products liquefied in the condenser flowed backwards against the stream of gas; and in another, the heavy tar-fog contained in the gas leaving the hydraulic main was largely removed by a special straining-tower before the gas passed to the condensers proper.

In order to investigate these points, I was instructed (1) to carry out experiments at Works C, where the existing plant could be most readily modified in the necessary manner, to determine as far as possible the effect on the light oils and naphthalene content of the gas of removing the tar-fog from the hot gas before the condensers, and also of the relative effect of allowing the condensed products to flow with or against the stream of gas in the condensers. At Works F, where naphthalene trouble was perhaps the greatest, I was instructed to ascertain the effect of artificially increasing the amount of light oils present in the condensers during the cooling of the gas, and I submit below the results obtained during the course of the work.

### Investigation of the Effect of the Removal of Tar-Fog from the Gas before Condensation.

At Works C the existing condenser was of the horizontal atmospheric tubular type, constructed of 12-inch pipes, in which the whole of the products of condensation flowed from the top to the bottom of the condenser, where they were removed. The connections were so arranged that the gas could be passed upwards or downwards through the condenser as desired, so that in the former case the products flowed against the gas stream (counter-current), and were removed at the hot end, and in the latter case flowed with the gas stream (direct-current), and were removed at the cold end. To carry out the experiments, a "Cyclone" tar extractor was fixed at the condenser inlet, so as to remove the tar-fog before the gas entered the condenser. All the tar flowing with the gas along the foul main was drawn off before the "Cyclone" inlet, so that the tar separated by the latter must have all been present in the form of fog.

With this apparatus it was then possible to test the effect of the removal of the tar-fog, and also to determine how far the results were affected by working counter-current or direct-current in the relative flow of tar and gas. With regard to the latter point, it was found that it makes no appreciable difference to the amount of naphthalene or light oils left in the gas whichever plan is adopted; and this remains true whether the tar-fog is removed or not. It had been expected *a priori* that better results would have been obtained with the counter-current; and that no such advantage is obtained in practice is probably due to the fact that the large quantities of specifically lighter ammoniacal liquor separating along with the tar in the condensers tend to cover the latter over, and prevent the exertion of its full absorbent action on the gas.

More favourable results were obtained from the removal of the tar-fog. The gas entered the "Cyclone" separator at a temperature of 120° to 140° Fahr., the total amount of liquid removed by the apparatus being about 4·5 gallons per ton of coal, 3 gallons of which was tar and 1·5 gallons liquor. The amount of already condensed tar present in the hot gas issuing from the hydraulic main at this works therefore amounted to no less than about one-third of the total production.

When the tar-fog was thus removed, the product separating in the condenser consisted chiefly of ammoniacal liquor; the total quantity of tar obtained from the condenser then only amounting to about one-third of a gallon per ton of coal carbonized. This tar, however, was very different from ordinary coal tar; being a thin liquid more nearly resembling oil tar in consistency. The difference in composition between this tar and the average coal tar produced at this works is shown by the following analysis of each tar (freed from water):—

| | Average Tar. | Condenser Tar after Removal of Tar-Fog. |
|---|---|---|
| Up to 170° C. | 1·5 .. | 11·2 per cent. |
| 170–270° C. | 16·2 .. | 51·3 ,, |
| 270–350° C. | 17·2 .. | 2·9 ,, |
| Pitch | 64·5 .. | 33·0 ,, |
| Naphthalene (about) | 12·0 .. | 30·0 ,, |

Taking the quantity of pitch in the latter tar as due to heavy tar-fog which had not been removed by the separator, these figures show that the latter had removed about 95 per cent. of the total tar-fog passing through it.

A summary of the results of the tests made during the summer of 1903, when no tar-fog separation was carried out, and the corresponding results in 1904 and 1905, after the installation of the separator, are given in Table A. During the winter months the amount of naphthalene in the gas at these works is very low, whether the tar-fog separation is carried out or not.

During the whole of this period, the coal carbonized was a fairly uniform mixture of Durham and South Yorkshire coal; the proportion of the latter being rather more than 50 per cent.

In 1903 and 1904, the general conditions, other than the presence of the tar separator, were, as nearly as could be determined, fairly uniform, and the make of gas per ton in each year averaged about 10,500 cubic feet. The results in the latter year, so far as naphthalene removal was concerned, were very favourable both as regards the maximum and the average quantities found, which were only about half the amount found in 1903. The amount of light-oil vapours was, however, but little affected by the removal of the heavy tar-fog, the small increase in 1904 being too slight for any weight to be laid upon it. No appreciable trouble was

* See "Journal," Vol. LXX., p. 16; and Vol. LXXV., p. 1712.
† *Ibid.*, Vol. LXXIII., p. 437.

TABLE A.—*Summary of Tests made at Works "C."*

| Period of Tests. | Method of Condensation Employed. | Make of Gas per Ton, about | Naphthalene in Purified Gas, Grains per 100 Cubic Feet. | | | Light Oil Vapours in Purified Gas, Cubic Centimetres per 100 Cubic Feet. | |
|---|---|---|---|---|---|---|---|
| | | | Max. | Min. | Aver. | 100°-130° C. | 130°-170° C. |
| April-October, 1903 . . . . . | No "Cyclone" tar separator in use. Horizontal atmospheric condenser used. | 10,500 c. ft. | 17·8 | 2·4 | 10·8 | 8·0 | 6·7 |
| April-October, 1904 . . . . . | "Cyclone" tar separator at work, with same condenser as in 1903. . . . . | 10,500 ,, | 8·3 | 3·8 | 5·6 | 8·8 | 6·7 |
| April-October, 1905 . . . . . | Same as in 1904 . . . . . | 11,000 ,, | 12·8 | 2·4 | 6·8 | 5·2 | 4·2 |

TABLE B.—*Summary of Results of Naphthalene Inquiry Tests made at the Silvertown Gas-Works.*

(1) TESTS MADE UNDER WINTER CONDITIONS—NOVEMBER, 1905, TO JANUARY, 1906.

| Method of Condensation. | Temperatures of Gas. | | | Naphthalene, Grains per 100 Cubic Feet. | | | | | | Light Oil Vapours, Cub. Cent. per 100 Cub. Ft. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Outlet of Condenser.* | | | Outlet of Meter. | | | | |
| | Inlet Cyclone. | Outlet Condenser. | Outlet Meter. | Max. | Min. | Aver. | Max. | Min. | Aver. | 100°-130°C. | 130°-170°C. |
| (1) "Cyclone" on, and No. 2 condenser tar flowing *against* the gas stream | 115° | 53° | 50° | 6·9 | 5·8 | 6·3 | 5·1 | 4·1 | 4·5 | 7·8 | 3·8 |
| (2) "Cyclone" off, No. 1 condenser on . | .. | 48° | 47° | 19·7 | 8·0 | 10·4 | 8·0 | 5·2 | 6·7 | 9·1 | 3·2 |
| (3) "Cyclone" on, and No. 2 condenser tar flowing *with* the gas stream | 110° | 48° | 48° | 12·3 | 7·6 | 9·7 | 7·4 | 4·6 | 6·4 | 3·9 | 2·5 |
| (4) Same as No. 1. . . . . | 109° | 51° | 49° | 12·3 | 9·4 | 10·5 | 7·1 | 2·4 | 4·5 | 4·7 | 2·6 |

(2) TESTS MADE UNDER SUMMER CONDITIONS—AUGUST AND SEPTEMBER, 1906.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) "Cyclone" on, and No. 2 condenser tar flowing *against* the gas stream | 125° | 85° | 72° | 28·6 | 24·3 | 26·7 | 7·6 | 2·4 | 4·9 | 1·5 | 1·6 |
| (2) "Cyclone" off, No. 1 condenser on . | .. | 81° | 72° | 46·3 | 21·8 | 32·8 | 4·7 | 5·1 | 8·5 | 2·3 | 1·7 |
| (3) "Cyclone" on, and No. 2 condenser tar flowing *with* the gas stream | 122° | 62° | 64° | 20·0 | 15·7 | 17·2 | 4·3 | 2·6 | 3·7 | 2·7 | 2·0 |

* The tests at the condenser outlet were made as follows: A 1-inch connection was arranged between the inlet and outlet of the exhauster, which is immediately after the condenser, and the gas in traversing this connection passed through three miniature Pelouze tar-extractors, the gas for the test being taken off after it had passed through the latter. Even then a small and varying amount of tar got through into the test solution, so that all the tests are too high by an unknown and irregular amount, and no great weight can be attached to them.

experienced on the works or in the district during either of these two years; but, so far as the district is concerned, little stress can be laid on this, inasmuch as the delivered gas is mixed with a large percentage of carburetted water gas.

At the end of the summer, the condenser had to be taken down for re-erection on another site; and in doing so it was found that the pipes were entirely free from any accumulation of either naphthalene or thick tar. So far, therefore, the results were encouraging; but it was felt that further experience was necessary before coming to any definite conclusion, and the tests were repeated in the summer of 1905. In this period an important change had occurred in the conditions as compared with 1903 and 1904, inasmuch as the yield of gas from the same general class of coal had been raised from about 10,500 cubic feet to 11,000 cubic feet per ton, in consequence of which there was an increase in the quantity of naphthalene and a decrease in the quantity of light oils produced in the retort. Under these altered conditions, the amount of naphthalene left in the gas was found to be slightly higher than in 1904, but still decidedly lower than in 1903, when the make of gas was 500 cubic feet per ton lower, but no tar-fog separator was at work. The amount of light oils in the purified gas had, however, undergone a very material reduction; being only about two-thirds the quantities found in 1903 and 1904.

With this reduction in the amount of light oils produced in the carbonization of the coal, a serious difficulty made its appearance. Under these conditions, after the removal of the heavy tar-fog previous to condensation, the amount of liquid hydrocarbons and other oils separating in the condensers was no longer sufficient to retain all the simultaneously condensed naphthalene in solution; and as the tar cooled, naphthalene crystallized out from the tar in the cooler parts of the condenser, which gradually became blocked with a pasty mass of small naphthalene crystals. Simultaneously the tar particles carried forward with the gas into the scrubbers also deposited a pasty mass of naphthalene in the latter—especially at the point where the fresh water entered. The deposition of naphthalene from the tar in the scrubbers appears to be due to two causes—namely, (1) the reduction of temperature causing naphthalene to crystallize out from the tar, and (2) the action first pointed out by Messrs. White and Clary, of the Michigan University (see "JOURNAL OF GAS LIGHTING," Vol. XCII., p. 388)—namely, that the ammoniacal liquor removes from the tar some of its carbolic acid, which is an excellent solvent for naphthalene; thus bringing about a further separation of naphthalene crystals.

During the present year (1906), no regular investigation has been carried out at these works, but occasional examination has been made, and some facts of interest have been noted. In the spring, altered conditions of carbonizing took place at the works—an entirely new retort-house being brought into operation, and the old one shut down; and almost simultaneously alteration was made in the coal carbonized, all South Yorkshire and no Durham coal being used. Under the new conditions, the trouble from naphthalene stoppages in the condenser disappeared, in spite of the fact that the make of gas per ton was increased to nearly 12,000 cubic feet. Determinations of the amount of light oils in the gas gave the following results:—

Oils distilling between 100° and 130°C. = 6·3 c.c. per 100 cubic feet.
,, 130° ,, 170°C. = 6·0 ,,

showing that these were now nearly as high as in 1903 and 1904, in spite of the greatly increased yield of gas. How far this increase is due to the change in the nature of the coals, and how far to the altered carbonizing conditions in the new house, there are no available data to show.

Occasional tests for naphthalene made during June and July showed the presence of only the merest traces in the purified gas. During the exceptionally hot weather at the end of August (the hottest weather for many years past), five tests were made which gave results between 6·1 and 9·7 grains per 100 cubic feet, or an average of 7·5 grains, which compares favourably with the amount found in 1903 at the hottest period (15 to 18 grains), when no tar-fog separation was carried out.

As the coal carbonized at Works C was not all Durham coal, it was felt that it would be better to repeat the experiments at a works using coals from that field only; this being the actual case in the great majority of works in the Southern district. By the kindness of the Directors of the Gaslight and Coke Company, permission was given to carry out such experiments at their Silvertown works, which are chiefly used as experimental works for coal-testing. The condensing plant at these works consisted of an atmospheric vertical condenser, in which the gas travelled alternately up and down the vertical chambers; the tar being removed separately from the bottom of each chamber. From this condenser, the gas could, if required, be passed through a vertical atmospheric tubular condenser, consisting of twenty-four 12-inch pipes, about 20 feet long; the gas dividing itself into 24 streams passing separately down each pipe, and re-uniting in a common chamber at the bottom. A "Cyclone" tar separator was fixed just outside the retort-house in such a manner that the gas passed into it direct from the foul main—the outlet being connected to the second condenser; and the connections of the latter were altered so as to permit the gas to travel upwards (counter-current) or downwards (direct-current) through the vertical pipes as desired. In this manner it was possible to make tests with the tar-fog removed, and with either counter-current or direct-current in the second condenser, or the tar-separator and second condenser could be shut off, and the condensation carried on in the old way in the first condenser without removal of the tar-fog.

The quantity of coal carbonized at Silvertown is practically constant throughout the year, amounting to about 30 tons per diem; but as these works are used primarily for coal-testing, the variety of coal carbonized was altered every few days. From

the point of view of these experiments, this was, of course, a disadvantage, as it introduced another source of variation other than that made by alteration in the condensing conditions. In the first set of tests made under winter conditions in November-January last, most of the coals carbonized were from the Durham field. But a few samples of South Yorkshire and Westphalian coals were carbonized; and during this period the make of gas per ton varied from 10,200 to 12,300 cubic feet. In the second set of tests, made under summer conditions in August and September last, only Durham coals were carbonized; and the make of gas per ton varied from 10,600 to 12,400 cubic feet. The results of the two sets of tests are given in Table B.

The winter tests were not altogether satisfactory for several reasons. The foul-main area within the retort-house is relatively large, and in the cold weather the temperature of the gas was considerably reduced before reaching the tar-fog separator; so that the temperature at which the heavy tar-fog was extracted from the gas varied considerably, the maximum being 130° and the minimum 78°. The condenser itself was also relatively large, so that the temperature of the gas at the outlet was much lower than is the case in general practice; being sometimes as low as 38°, and only twice reaching 60°. Further, the amount of light oils found fluctuated greatly, owing to the above-mentioned variation in the nature of the coals carbonized. Generally, however, it will be seen that, as at Works C, the amount of naphthalene left in the purified gas was lower when the tar-fog was removed before the condensers.

More uniform conditions prevailed in the tests made under summer conditions; the tar-fog being removed at a higher and more uniform temperature. The outlet condenser temperatures were also more uniform during each of the separate series of summer tests, though, owing to the cooler weather in the middle of September, it was lower on the average during the last series of tests (3) than in the first and second series. It will be noticed that the amount of light oils in the gas, although as uniform as could be expected with the constant variation in the coals, is throughout very low, being, in fact, much lower than at any works where I have carried out similar tests, and where Durham coals are also used. Evidently the carbonizing conditions at Silvertown are such that a low production of light oils takes place.

In spite, however, of this low quantity of light oils, the effect of removing the tar-fog was here also favourable as regards the naphthalene left in the purified gas, the amount being lower when this removal was carried out, whether the condenser was worked on the counter-current or the direct-current principle. Better results were obtained with the latter method of working; but in that case the condenser outlet temperature was 23° lower than in the former case, which probably accounts in itself for the better result.

With regard to the deposition of naphthalene in the condensers, the length of the period over which the tests were continued was insufficient to cause any increase of back-pressure in the latter. On opening up the condenser at the end of the winter tests, however, it was found that the pipes, which had been cleaned at the commencement of the tests, had a thin coating of a tarry paste of naphthalene; and in time these, as at Works C, would in all probability have also become blocked.

I should like here to express my thanks to Mr. Goulden, the Chief Engineer, and to Mr. Wilton, the Manager at Silvertown, for the way in which they carried out the necessary alterations to the plant to enable the experiments to be carried out, and also to Mr. P. Gwynn Jenkins, the Chemist at the works, for much assistance in carrying out the work.

While this work has been in progress, investigations on somewhat similar lines have been carried out by others, to which reference may here be made. Mr. Everitt, of Ilkley, has also removed the tar-fog from the hot gas by means of his tar-screens, and by the addition of steam at this point has at the same time driven forward some of the more volatile constituents of the separated tar into the condensers; and according to an article in the "Gas World," Vol. XLIV. [1906], p. 227, it appears that he in this manner obtains an almost complete removal of naphthalene from the purified gas. No information is given in that article as to the amount of light-oil vapours in the gas; but as Ilkley supplies 18-candle gas, and doubtless carbonizes Yorkshire coals, the amount of such vapours is in all probability much higher than in the works which have been examined in the present inquiry.

During the same period, Professor A. H. White, of the Michigan University, in conjunction with other co-workers, has been carrying out an important investigation of the condensing system in a number of works in the United States, the results of which have been given to the Michigan Gas Association. (See "Journal of Gas Lighting," Vol. XCII., pp. 388, 466, Vol. XCVI., p. 181, 244, 324, and "Gas World," Vol. XLIII., p. 808, Vol. XLV., p. 613.) Reference has already been made to their work in connection with the action of the ammoniacal liquor on the tar in the scrubbers and its effect on the naphthalene; but the major part of their research relates to the effect of the removal of tar-fog from the gas on the elimination of naphthalene. The results published last year were, so far as practical issues were concerned, in many ways similar to those obtained in this district, although as regards some of the theoretical conclusions and the interpretation of the results of some of the experiments I was unable to agree with these investigators. As this point has already been discussed elsewhere (see "Journal of Gas Lighting," Vol. XCII. [1905], pp. 526, 596, 672), it is unnecessary to repeat the criticisms here, especially as for the most part they do not apply to the further results and conclusions given in their paper published last week.

Generally speaking, the American authors find that the removal of the tar-fog from the gas before it is completely cooled, has a beneficial effect; but in one instance, just as at some of the works investigated here, it was found that such removal was actually disadvantageous, and resulted in the rapid blocking of the subsequent apparatus. This was the case at the Detroit Gas-Works (see "Gas World," Vol. XLV. [1906], p. 617). The authors have not determined the amount of light oils present in the gas at the various works examined; but from the results which have been detailed above, it seems probable that at this particular works the amount of light oils produced is lower than at the other works.

From the results obtained in the investigation by Mr. Everitt at Ilkley, and by Professor White and his co-workers in the United States, it therefore appears most probable that the removal of the tar fog from the crude gas before it is completely cooled is of advantage from the point of view of naphthalene trouble, provided that the quantity of light oils in the gas exceeds a certain minimum. If, however, the amount of such oils falls below that minimum, this procedure, while it results in a reduction of the quantity of naphthalene left in the gas, causes increased deposition of naphthalene, or tarry masses containing much solid naphthalene, in the subsequent condensing and scrubbing plant. In the case of Durham coals in particular, carbonized under present conditions, the yield of light oils appears in most cases to be below the minimum limit. Therefore, to adopt this method with complete success in such cases, it will be necessary to increase by some means the amount of light oils present in the condenser during the cooling. Further reference to this point will be made after describing the work carried out at Works F.

Before leaving this part of the subject, reference must also be made to the valuable criticisms of Messrs. William Young and Thomas Glover in regard to the removal of the hot tar-fog. They rightly point out that if this tar-fog is allowed to cool with the gas it is capable of removing more naphthalene from the gas; so that its removal while hot prevents its exerting its full solvent power on naphthalene. This is undoubtedly the case. But, on the other hand, when the fog is removed before condensation, the tar separating in the condensers, although it contains a higher percentage of naphthalene, contains a proportionally higher amount of light oils and less pitch; and it was expected that the actual vapour pressure of the naphthalene in the latter tar would be lower than of that hydrocarbon in the ordinary tar, which from Durham coals especially is nearly saturated at the ordinary temperature, and it is largely the vapour pressure of the naphthalene in the tar with which the gas is in contact at the lowest temperature which determines the amount of it left in the gas. The two factors, therefore, work in opposite directions; and the question as to which of the two had the greatest value could only be decided by trial. The results of the tests given above show that, so far as naphthalene removal only is concerned, the advantage outbalances the disadvantage, and a greater reduction is, in fact, obtained. Nevertheless, when the amount of light oils in the gas is low (and it was to such cases only that Mr. Young applied the criticism), difficulty does occur, not from more naphthalene being left in the gas, but from the separation of it from the tar on cooling in the condensers and scrubbers, with the result that these get blocked.

As an alternative to the method of removing the tar-fog while hot, and arranging for a supplementary supply of solvents in the condenser, Messrs. Young and Glover suggest that where the amount of light-oil is low, it is better to cool the gas and tar together to as low a temperature as possible. When gas of high quality is being made, such a procedure is not recommended, as it results in considerable reduction of the illuminating power; but where high yields of gas of lower quality are obtained, the reduction of illuminating power so brought about is negligible. There is no doubt that by this method, where water condensers are used and a good supply of cold water is available (which is, however, by no means the case in all works), the naphthalene in the gas can be very considerably reduced; and, in practice, Mr. Thomas Glover has found at Norwich that under these conditions only a few grains per 100 cubic feet are left in the gas. On the other hand, the amount cannot be reduced to a lower limit than that which corresponds to the vapour pressure of the naphthalene in the tar used; and in many cases this is considerable, even at 60°. Moreover, the very method employed to more effectually remove the naphthalene simultaneously reduces the already small amount of light-oil vapours in the gas, and especially those of higher boiling-point; so that in many cases, in spite of the lower quantity of naphthalene present, this will still tend to separate out at times in the solid form on cooling, especially in the district, owing to the very low amount of vapours of liquid hydrocarbons in the gas. To ensure entire immunity from trouble, it seems most likely that this method of condensation will still have to be supplemented by some arrangement for adding light-oil vapours or mist to the gas at a point subsequent to the condensers, in the manner described and successfully employed by Messrs. Young and Glover themselves, as well as by Messrs. Botley, Colson, Bell, and others.

A further trouble, which is not unlikely to occur with the above method of condensation, is that the tar obtained now is in many

cases very thick, and flows with great difficulty when cooled as low as 60°, as it would be under these conditions; and in addition to the difficulty in handling thus entailed, there will also, to judge from samples of coal tar I have recently had to deal with, be great trouble in obtaining a proper separation of the enclosed liquor from such tar without subsequently reheating it.

### Investigation of the Effect of Adding Light Oils to the Gas in the Condenser.

These experiments were carried out at Works F, where great trouble was experienced from naphthalene deposits, both in the works and on the district, and where, under the then existing conditions, the highest amount of naphthalene had been found in the purified gas. The intention was eventually to obtain the necessary supply of additional light oils from the coal tar made at the works, or other suitable source; but, for the purposes of the investigation, the oil used in the first instance was purchased, leaving the best source of the oils for later investigation, if it was found that such addition was advantageous.

The coal carbonized at these works has throughout consisted of one class only—namely, Ravensworth Pelaw. The condensers were two in number—the first being of the vertical annular type, having six pipes, the gas passing alternately up and down, and the tar and liquor flowing separately from each section at the bottom; and the second of the battery type, the flow of gas being as usual alternately up and down. Since the investigation was commenced, a third condenser of the tubular water-cooled type has been added, in which the gas passes downwards together with the tar; but this was not in use during the greater part of the period in which the tests described below were made. The make of gas was from 10,000 to 10,200 cubic feet per ton.

The light oil first employed was a heavy naphtha consisting mainly of xylenes and cumenes, 90 per cent. of which boiled between 140° and 170° C. This was run into a small surface carburettor heated by steam, and a small stream of gas from the exhauster outlet passed over the heated surface; the warm gas, laden with naphtha vapours, being then introduced into the battery condenser at a point about midway between the inlet and the outlet. Both condensers were worked in series—the battery being the second. The amount of oil added was regulated to about 10 gallons per million cubic feet (equal to about 4·5 cc. per 100 cubic feet).

Before the experiments commenced, the amount of naphthalene in the gas at the condenser outlet was running from 18 to 22 grains per 100 cubic feet. After some preliminary difficulties had been overcome, and regular admission of the oil effected continuously, the amount of naphthalene at the exhauster outlet fell to 7 to 9 grains; and after a further two days, it almost completely disappeared from the gas at this point—only traces of naphthalene picrate being precipitated—and the amount found on working off the test was only 0·4 grain. During the next night, the supply of oil stopped at some period, owing to the cock becoming blocked; and the naphthalene shown by the test during that period rose to 8 grains. Next night, when the light oil addition went on continuously, the amount again fell to 0·3 grain.

These results were most encouraging, and hopes were raised accordingly; but, unfortunately, these were, as has so frequently been the case with naphthalene, only raised to be promptly dispelled. From that time the amount of naphthalene in the gas steadily increased to a quantity varying from 8 to 12 grains, although it never reached the former figures of 18 to 22 grains. Many alterations were made in the quality and amount of naphtha added, and in the point at which it was added to the condenser, in the hope of once more bringing about the removal of almost the whole of the naphthalene, but without success. After some months of trials, the work had to be given up in December, 1904, as, under the then existing conditions, the naphthalene again disappeared from the gas at the condenser outlet, even when no light oils were being added. This state of things continued until the following April, when the work was recommenced, and continued throughout the summer; but still no better results were obtained than 8 to 12 grains of naphthalene in the gas. In the autumn the fraction of light creosote employed by Mr. Colson at Leicester as a naphthalene preventive was substituted for the heavy naphtha, but still with the same general result.

The most probable cause of the variation appeared to be the presence of the tar-fog in the condensers; but it was impossible, without great alteration of mains, to arrange for the provision of a tar-fog separator before the condensers. Experiments were therefore made to try the effect of adding the oil vapours after the condenser and tar-extractor. But it was not found possible to make any tests of the effect, as the plant and mains subsequent to that point contained large deposits of naphthalene from previous working; so that, even if the latter had been removed from the gas by the addition of the light oils, it would be rapidly picked up again from these old deposits.

From the experience thus obtained, it does not appear likely that the addition of light oils in quantities which are commercially possible, can be rendered regularly effective, unless the heavy tar-fog is first removed from the gas; and hitherto it has not been possible to make a trial of such a method of working on a manufacturing scale. This plan will, however, shortly be tried at another works on an entirely new section of condensing and scrubbing plant. Experiments have therefore been made to determine the most suitable source of the light oils for use in this trial. It was originally hoped that the tar obtained from the condensers when the tar-fog had been previously removed would prove a suitable source, as this is so much richer in the required hydrocarbons; but the total quantity of such tar formed proves, as has been already stated, to be so small, and the quantity of naphthalene in it so large, that its employment does not seem practicable. A far more suitable material is to be found in carburetted water-gas tar, which is normally rich in light oils, and comparatively free from naphthalene; and this will be employed in the trials at the above works as soon as the new section is completed.

### Other Experiments.

As opportunity has offered, other experiments bearing on the subject have been carried out.

Mr. J. F. Bell, of Derby, found that beneficial results were obtained there by pumping the tar over the hot end of the condenser. The tar from the Derbyshire coals used at Derby contains more light oils and less naphthalene than that from Durham coals; and it did not appear probable that a corresponding benefit would be obtained by using the latter tar. But it was thought advisable to put the matter to actual test. Arrangements were therefore made at Works E for this purpose; the tar being pumped continuously through the first section of the annular condenser, the temperature of the gas at this point being about 130° Fahr. The results were all in accordance with expectation—no effect, either favourable or adverse, being produced.

At the same works, Messrs. Botley's carburation process was at work, and was treating the gas going out on to one of the three districts supplied, with complete success in preventing naphthalene stoppages; while from the same gas going out to the other districts without treatment much separation of naphthalene was taking place. It was thought advisable to ascertain the effect of the process on the amount of naphthalene in the gas; and for this purpose tests were made of the gas before treatment, and also a simultaneous test of the treated gas—the sample for the latter test being taken from the main at a point in the district about 200 yards from the carburetting apparatus, in order to allow of the subsidence from the gas of the larger particles of paraffin mist. The results were as follows:—

| | Untreated Gas. | | Treated Gas. |
|---|---|---|---|
| Naphthalene . . | 10·6 grains | .. | 4·3 grains |
| ,, . . | 14·6 ,, | .. | 4·9 ,, |
| ,, . . | 10·0 ,, | .. | 5·1 ,, |
| ,, . . | 13·1 ,, | .. | 7·2 ,, |
| Average . . | 12·1 grains | .. | 5·4 grains |

showing that considerable removal of naphthalene had occurred by the time the gas had travelled the above distance.

In place of the higher-boiling paraffin, the more volatile heavy naphtha (of the same quality as that used in the experiments at Works F) was used in the Botley apparatus, in order to see whether the addition of this, in quantities of about 10 gallons per million cubic feet, would also effect any reduction in the quantity of naphthalene. As the gas is capable of retaining the whole of this quantity as vapour, it was not expected that any reduction would be obtained, and none was, in fact, observed. During the week that this naphtha was used, no stoppages from naphthalene occurred in the district supplied with the gas thus treated, although large numbers were simultaneously experienced in the districts supplied with the same gas untreated. The period of a week is, however, too short to show that the addition of the above amount of naphtha would always prevent the precipitation of solid naphthalene.

During the time that this investigation with regard to the removal of the naphthalene in the condensers themselves has been in progress, much work has been done, and success gained, elsewhere with regard to the removal of naphthalene subsequent to condensation, by washing the gas with suitable oils, as has been described especially by Messrs. Young and Glover, Bueb, Bell, and Colson, and also with regard to the treatment of the purified gas by adding to it supplementary quantities of solvent oils before going into the district, as in Messrs. Botley's process, and in one of those employed by Messrs. Young and Glover.

In conclusion, it is with very great pleasure that I express my hearty thanks to the engineers and others at the various works where the investigation has been carried on, for their invaluable co-operation throughout, as also to many of the above-named gentlemen who have been engaged in the investigation and working of processes involving washing the gas with solvent oils after the condenser, for their kindness in affording me much information with regard to their results.

Yours faithfully,

Harold G. Colman.

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The annual *conversazione* of the Society of Engineers was held last Wednesday evening at the Royal United Service Institution, Whitehall. Mr. Maurice Wilson, Assoc.M.Inst.C.E., the President, and Mrs. Wilson, with Mr. Perry F. Nursey, the Secretary, received the guests, who numbered about 350. Among those who had accepted invitations were representatives of the principal engineering institutions in London. The museum was open to the inspection of visitors; the band of the 22nd Middlesex Rifles being stationed in the gallery. A selection of vocal music was given in the lecture theatre.

# MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

**Lecture by Dr. Grossmann on "Modern Chemical Developments in the Dry Distillation of Coal."**

The first of a series of Annual Lectures to be delivered by professional gentlemen before the above Association took place at the Manchester School of Technology last Saturday. The lecturer was Dr. J. GROSSMANN, M.A., F.I.C., &c., who chose the subject mentioned above for his discourse. An invitation had been issued to the members of the Manchester District Institution of Gas Engineers to join the Juniors on this occasion; and altogether there was a good attendance.

The PRESIDENT (Mr. R. H. Ginman, of Tyldesley), in opening the proceedings, said he could not help expressing his thanks to the members for their attendance in such numbers to listen to what undoubtedly would be a useful and valuable discourse. He was also pleased to see present a few visitors, and notably some from the Manchester District Institution. He was delighted that they were taking kindly interest in the proceedings of the Juniors; and the latter very much appreciated their presence. He had great pleasure in asking Dr. Grossmann to give them his lecture.

Dr. GROSSMANN at once complied with the request; and spoke as follows:—

The developments which chemistry has wrought in the manufacture of gas, and the influence which the manufacture of gas has exercised on the development of the chemical industry, form one of the most important chapters in the history of chemical technology. The manufacture of gas, which was commenced with the sole aim of producing an illuminant, has already entered, or will in the near future enter, the stage where the original product aimed at is commercially of secondary importance, and what used to be considered bye-products will be the chief products on which the manufacture depends.

The fact that the gas manager now relies to such a large extent on the recovery of bye-products, and on getting the utmost value for them, has led to the necessary consequence of his having to enter into manufacturing operations which formerly were considered out of his province. Cyanides, ferrocyanides, sulphocyanides, benzol, toluol, and similar compounds, and last, but not least, ammonium sulphate and other ammonia salts are now produced at gas-works; and while they add to the revenue, they entail not only further additional work on the responsible head of the department, but introduce further complications into the management of the works. Nowhere are these more pronounced than in the chemical problems which have to be faced in the production of sulphate and in the disposal of the gaseous and liquid effluents, consisting of sulphuretted hydrogen, prussic acid, sulphocyanides, phenols, and many other compounds.

It is well known that coal contains from 1·3 to 1·7 per cent. of nitrogen; and it should, therefore, on dry distillation, yield from 35 to 46 lbs. of $NH_3$ per ton, equal to from 136 to 180 lbs. of ammonium sulphate. Taking 22 lbs. of ammonium sulphate as an average yield, we find that only about one-seventh of the nitrogen present is obtained as ammonia. According to the late Professor William Foster, the rest is distributed somewhat in the following manner:—

| | | | |
|---|---|---|---|
| In cyanogen compounds. . . . | One-seventieth | of the | total N. |
| As nitrogen in the gas . . . . | One-third | ,, | ,, |
| Remaining in coke . . . . | One-half | ,, | ,, |
| In coal tar . . . . . | One-sixtieth | ,, | ,, |

According to these data, the amount of cyanogen produced from coal, calculated as hydrocyanic acid, would be about 16 per cent. on the actual quantity of ammonia recovered. This does not appear to be borne out by the 42nd report of the Chief Alkali Inspector, according to which, in gas-works, the average percentage of total cyanogen to ammonia works out to 8·9 per cent., and in coke-oven liquors it works out at 6·1 per cent. The lower figure is probably due to the fact that more oxygen is liable to mix with the gases in coke-works than in gas-works, and thus to destroy part of the cyanogen compounds. The discrepancy between the two is due to the fact that, while the Chief Inspector is only dealing, in the instance quoted, with the cyanogen compounds found in gas liquors, Professor Foster's calculation refers to the total amount produced on dry distillation.

There appears to be no doubt that, in the gas obtained by dry distillation, ammonia is produced first; and then, by the action of carbon or hydrocarbons, it is converted into ammonium cyanide. The quantity of cyanogen compounds present is therefore due to the destruction of ammonia; and, unless these compounds are recovered, they represent a loss in the yield of ammonia which would amount to 10 per cent. It may be safely assumed that, in the first stage of condensation, ammonia liquor also contains the cyanogen compounds in the state of ammonium cyanide, and that the ferrocyanide and sulphocyanide found in the liquors are products due to secondary reactions. The ferrocyanides are due to the presence of sulphide of iron in relatively small quantities—*i.e.*, not much more than one molecule of ferrous sulphide to six molecules of ammonium cyanide; for under these conditions only the soluble ferrocyanide of ammonium $(NH_4)_4FeCy_6$ is formed. The sulphocyanide is due to the presence of polysulphide; and the reaction by which it is formed is as follows:—

$$(NH_4)_2S_2 + NH_4CN = (NH_4)CNS + (NH_4)_2S.$$

If it were possible to exclude all iron in the condensing apparatus, and to prevent the formation of polysulphides in ammonia liquor, there would be neither ferrocyanide nor sulphocyanide contained in them, but all the cyanogen would be there as ammonium cyanide.

Ammonium cyanide is an exceedingly volatile substance; and it is more than probable that it is not completely absorbed by the ammonia liquor. In solution, it gradually decomposes into ammonium carbonate; and if no iron sulphide or polysulphides were present, ammonia liquor, on being left standing for a sufficiently long time, would probably be free from cyanide, and gain its equivalent in ammonium carbonate. But as ammonium sulphide has a tendency to form polysulphides on standing, part at any rate of the ammonium cyanide will be converted into sulphocyanide, while probably part of it may produce ammonium carbonate. The liquors referred to as showing only 8·9 per cent. of cyanogen calculated on the total ammonia, when according to Professor Foster they ought to show nearly double that amount, had been stored for a considerable time. They were rich in sulphocyanide; and it is not impossible that another part of the cyanide they contained originally had disappeared through being converted into ammonium carbonate. The storing of gas liquors for considerable periods (if loss from other causes can be avoided), should, therefore, be of advantage, in so far as it may increase the yield in ammonia. But even at the best, we find that 5 per cent. of the ammonia available is lost in the cyanogen compounds. In 1905, the production from gas-works amounted to 1559·57 tons; the loss through cyanogen compounds, calculated on the equivalent in ammonia, is equal to 7797 tons at the least—*i.e.*, to over £93,000. In coke-oven works, the loss from this source comes to nearly 1000 tons, equal to £12,000. There is altogether therefore a loss of over £100,000. The actual loss is much greater, as cyanides are more valuable than ammonia.

It is only natural that, under the circumstances, there should have been a desire to obtain some benefit from these compounds; and, in most plans of working, a certain amount of the cyanides has become a source of revenue to the gas-works by being retained in the oxide purifiers and paid for on the basis of the percentage of cyanogen compounds which the spent oxide contains. Nor does this entail any extra expense, as oxide purifiers have to be used in almost every works. But the price obtained for cyanides in oxide is only a fraction of their market value in the pure state, as it is difficult to separate them from the other ingredients with which they are mixed.

Broadly speaking, spent oxides contain about 40 per cent. of sulphur, from 4·5 to 10 per cent. of prussian blue, from 0 to 3 per cent. of ammonia (chiefly in the form of sulphate and sulphocyanide), from 13 to 14 per cent. of ferric hydrate, and 25 per cent. of water and lime, magnesia, silica, organic substances, &c.

The recovery of cyanogen compounds from spent oxide is effected by two fundamental methods, of which it may be said that they form the basis of all processes which have been proposed for the purpose. In the first method, the sulphur is removed by extraction, and the remaining residue treated in a similar manner to the methods applied in the second method. The material used for extraction is carbon bisulphide. The difficulties of this process—besides the unpleasant nature of the extracting material—consist in the presence of tarry matters, which, being also soluble in carbon bisulphide, remain mixed with the extracted sulphur, and considerably deteriorate its quality and value. The apparatus used for the purpose is complicated and costly. An installation for the working-up of batches of 2½ tons of spent oxide is composed of five extraction vessels, each holding half-a-ton of oxide; three stills; a set of condensers; and machinery for the charging and discharging of the mass. As stated before, this is only a preliminary step, and the recovery of cyanides proper has to follow. It is easy to understand why this process has not been taken up by gas-works.

By the second general principle of working up spent oxide, the latter is first lixiviated with water, after which the insoluble ferrocyanides are brought in solution by treating with lime or alkali. The lixiviation with water is carried out in filter-boxes (with false bottoms) made of iron, or preferably of wood, as iron is strongly acted on by the resulting solution. A box 6 feet by 7 feet by 3 feet high holds about 3 tons of spent oxide. Eight of these work in a battery; so that the liquor from one is run into the next box, and after passing through the system is fairly concentrated. The liquors contain chiefly sulphocyanide and sulphate of ammonia, from which ammonia is recovered by distillation—a very troublesome operation, as the ammonia, being all in the state of fixed ammonia, requires a large quantity of lime, which interferes with the fluid state of the mass. A mixture of lime and caustic soda has been found to give better results. If lime alone has been used, the resulting solution contains calcium ferrocyanide; from a mixture of lime and caustic soda in suitable proportion, the solution obtained contains sodium ferrocyanide as well. In either case the liquors also contain calcium sulphocyanide, ammonia, small quantities of calcium hydrate and sulphate, and (when bog ore has formed a constituent of the oxide purifiers) organic matter. The ferrocyanide is separated from these liquors either

by adding iron or ammonia compounds, or by adding potassium chloride. In the first instance, the reaction is as follows:—

$$Na_4\ Fe\ Cy_6 + Fe\ SO_4 = Na_2\ Fe_2\ Cy_6 + Na_2\ So_4$$

This, by means of oxidizing agents, is converted into $Na_2\ Fe_2\ (Fe\ Cy_6)_2$, which is a kind of prussian blue, distinguished by the property of being one of the worst known substances to filter. From this, ferrocyanide is obtained by decomposition with caustic soda.

The second method is based on the fact that calcium ferrocyanide forms with ammonium chloride an insoluble compound—

$$Ca_2\ Fe\ Cy_6 + 2\ NH_4Cl = Ca\ (NH_4)_2\ Fe\ Cy_6 + Ca\ Cl_2$$

This is not quite insoluble, and entails further work, which I need not describe in detail. The insoluble salt is boiled up with caustic soda to produce sodium, ferrocyanide, and to recover the ammonia.

Similar to this is the third process mentioned, in which potassium chloride is used instead of ammonium chloride. A difficultly-soluble calcium-potassium ferrocyanide is produced ($Ca\ K_2\ Fe\ Cy_6$), which is converted into potassium ferrocyanide by means of potassium carbonate.

Add to these processes those of refining the ferrocyanide, of recovering the sulphocyanide from the mother liquors, the disposal of the sulphur in the residual spent oxide, which is contaminated with lime, and it is not surprising that gas managers prefer to part with their spent oxide to those who make a speciality of working it up, though the price they obtain for it may not be satisfactory.

Still the fact remained that here was a valuable commodity, which, if it could be easily obtained, would, even at the present low market price for ferrocyanide of sodium, produce a further revenue of from 7½d. to 1s. 1d. per ton of coal carbonized. The problem was a tempting one; and it became more so as new and extensive application had been found for cyanogen compounds in the extraction of gold from tailings and poor ores. Thus, for some time at any rate, there was no fear of ferrocyanides, which formed the raw material for the production of cyanide, becoming a drug in the market. The idea, which up to six years ago formed the basis of all the modern proposals for the recovery of cyanogen compounds, was to extract them separately from the gas by converting the ammonium cyanide which it originally contains into a more stable compound—*i.e.*, ferrocyanide.

It appears that, as far back as 1875, it was proposed to wash the gas by means of oxide of iron suspended in water, in order to remove the sulphuretted hydrogen; and it was then pointed out that a further result would be that ferrocyanide of ammonium would be formed and go into solution. The matter lay dormant until 1886, when Dr. Knublauch took out a German patent for his process. He found that if a gas containing prussic acid, carbonic acid, and sulphuretted hydrogen is passed through a liquid containing ferrous hydrate and an alkali in the proper proportions, the precipitate of ferrous hydrate disappears gradually. Part of it becomes converted to soluble ferrocyanide of alkali; and only a fraction of the iron is converted into sulphide. The proportions for this reaction are one molecule of iron for each molecule of ferrocyanide. It is, therefore, possible, by washing the crude gas, to obtain a strong solution of sodium or potassium ferrocyanide direct from it, separately from the bulk of ammonia liquor.

Mr. William Foulis, of Glasgow, patented a process in 1892, the main point of which consists in first removing the ammonia from the crude gas, and then the cyanides, by passing the gas through a mixture of ferrous carbonate and caustic soda solution. In this process also a soluble ferrocyanide was aimed at; and at a meeting of gas managers in 1896, Mr. Charles Hunt gave a detailed and favourable account of the process. But it must not be forgotten that at that time ferrocyanides were worth two-and-a-half times as much as at present.

In 1898, Dr. Bueb patented a process which differs materially from the preceding ones inasmuch as his aim was to obtain the cyanogen compounds in an insoluble form. While Mr. Foulis first removed the ammonia from the gas and then removed the cyanogen, Dr. Bueb utilizes the ammonia contained in the crude gas for the purpose of fixing the cyanogen. Special washers are used for the purpose—similar to "Standard" washers, but with the difference that the liquid does not pass automatically through the apparatus, but is pumped at intervals from each chamber into the adjacent one. There are four chambers. The gas, after being carefully freed from tar, passes from the first to the second, third, and fourth chambers, while the wash-liquor enters the fourth chamber first, and is finally withdrawn at the first chamber. The changes which take place are as follows: A solution containing about 30 per cent. of crystallized ferrous sulphate is placed in the last chamber of the washer, where the gas is almost free from cyanogen, but contains ammonia and sulphuretted hydrogen. The following reaction takes place:—

$$Fe\ So_4 + H_2\ S + 2\ NH_3 = Fe\ S + (NH_4)_2\ So_4.$$

That is, ferrous sulphide and ammonium sulphate are produced. The former is kept in suspension by an agitator which is placed in the last chamber, and the muddy mass is pumped into the third, second, and first chambers, where the ammonium cyanide of the crude gas forms, by double decomposition with ferrous sulphide, an insoluble ammonium ferrous ferrocyanide, which, according to Dr. Bueb, has the composition $(NH_4)_2\ Fe\ Cy_6$, while sulphuretted hydrogen is set free from the ferrous sulphide and water and passes on with the gas.

The mud which leaves the last chamber is of yellow or brown colour, and contains a quantity of insoluble ferrocyanide equivalent to about 20 per cent. of prussiate, $K_4\ Fe\ Cy_6$, $3\ H_2O$ and from 6 to 7 per cent. of ammonia. This may be sold to manufacturers on the basis of its contents in cyanogen and ammonia, or it may be worked up to ferrocyanide by the gas-works, by distilling off the free ammonia with open steam, separating the mud from the supernatant ammonium sulphate solution by filter pressing, and recovering the sodium ferrocyanide by similar means, as shown in the case of insoluble salt produced in the working up of spent oxide.

This process confirms the statement that all cyanogen is originally in the state of ammonium cyanide in crude gas; for 95 per cent. of the total cyanogen may be recovered as insoluble iron compound, and only very small quantities of sulphocyanide are formed. The yield from coals varies from 2½ to 4½ lbs. of sodium ferrocyanide per ton. It is claimed as a further advantage, that the oxide, being entirely used up for the separation of sulphur, may yield a product, which, on the dry substance, will contain from 50 to 60 per cent. of sulphur.

Many other processes, having the same object in view, have been proposed, and some of these are said to work satisfactorily. Within the last few years, another series of processes has been brought forward, which also aims at removing the cyanogen compounds from the crude gas, but which effects this not through the formation of ferrocyanides but of sulphocyanides.

Up to the end of last century, there was only a very limited use for sulphocyanides—chiefly in calico printing. Since then, methods have been devised for manufacturing cyanides from sulphocyanides, first by Dr. Raschen, then by others; and, in consequence, the demand for these compounds became more pronounced. As a consequence, patents have been taken by Chance, Tcherniac, and others, to produce it from crude gas.

All these processes depend upon the property of ammonium cyanide of forming sulphocyanide when brought in contact with a polysulphide, such as an ammonium bisulphide—

$$(NH_4)_2\ S_2 + NH_4\ CN = NH_4\ CNS + (NH_4)_2\ S.$$

As polysulphides can be easily formed from the sulphide of ammonia by agitating it with sulphur, this has formed the principle on which one of the processes is based. The gas is passed through a washer containing a mixture of crude ammonia liquor and flowers of sulphur, and in this manner a strong solution of ammonium sulphocyanide is obtained, which may be sold as such on its valuation for ammonia and cyanogen, or which may be distilled with lime in a separate still to produce calcium sulphocyanide.

I have so far only dealt with the removal of the cyanogen compounds on commercial grounds. There is, however, another aspect from which this question must be viewed. But before discussing it, I must digress to deal with a matter which has so far not received the attention it deserves. I refer to the influence of cyanogen compounds on sulphur recovery. There are two ways in which, by more modern methods, the sulphur, passing away in the waste gases from ammonia stills as sulphuretted hydrogen, is dealt with. In the first instance, in works which make their own sulphuric acid, the sulphuretted hydrogen is burned and converted into sulphurous acid, which is taken into the sulphuric acid chambers. In this case, any prussic acid which is present in the gas produces ammonia on combustion, which, with the nitrous fumes present in the chambers, yields nitrite of ammonia, which again splits up into nitrogen and water, according to the equation—

$$NH_4NO_2 = 2\ N + 2\ H_2O.$$

We thus find that, for each equivalent of hydrocyanic acid, one equivalent of nitrate of soda is destroyed, so as to cause a loss in nitre. In like manner, where only a fraction of the sulphuretted hydrogen is burnt in a Claus kiln, so as to produce sulphur by the reaction $2\ H_2S + SO_2 = 3\ S + 2\ H_2O$, the sulphur produced contains ammonia, which thus becomes objectionable to the manufacturer of sulphuric acid. It may be asked how it is possible that hydrocyanic acid can pass from the stills which are kept alkaline to the saturator. This question has, to my knowledge, never been properly answered.

I believe that the explanation is as follows: It has been recently demonstrated beyond a doubt that the crude ammonia liquors contain considerable quantities of ammonium cyanide. Referring again to the Chief Alkali Inspector's report, we find in gas-works on an average as much as 2·2 per cent. of cyanogen per 100 parts of ammonia in the state of ammonium cyanide, ranging in different works from 6·3 per cent. down to nothing. In coke-oven liquors matters are even worse, as the average works out at 4·6 per cent. —ranging from 18·3 to 0·5 per cent. When these liquors pass into the ammonia still and are heated with lime, a momentary decomposition may take place by which calcium cyanide is formed from the ammonium cyanide present. But calcium cyanide is a very unstable compound, which on boiling parts with its cyanogen in the form of prussic acid; and thus the latter passes with the bulk of the ammonia gas into the saturator, and from this into the exit gases.

I have in my opening remarks alluded to the complications which have been introduced into gas-works through the further working up of their products, and prominent among these are the gaseous and liquid effluents produced in the working up of crude

ammonia liquors into ammonium sulphate. As regards the liquid effluents, gas-works situated in towns and with facilities for running their effluents into the sewers, have so far not been seriously troubled; but there are signs that there is, even in their case, a possibility that they may be required to purify them. The case is more serious where gas-works are situated in country districts, and have to discharge their effluents into small rivers or brooks, and most serious of all in coke-oven works, where one works in a small village may have effluents equal in quantity to those produced by a gas-works in a fairly large town. In the early stages of sewage purification, the spent gas liquors were not considered to interfere with the subsequent treatment of the sewage, so long as the solids were previously separated; but it has now become an open question whether the sulphocyanides and phenoloid bodies present in these liquors, even when diluted with sewage, may not interfere with the purification of the latter where it is subjected to bacteriological treatment. The injurious action of the compounds named lies in their property of absorbing large quantities of oxygen, and thus retarding the activity of the bacteria.

Attempts have of late been made to remove the sulphocyanides from the spent liquors by precipitation with copper. Cuprous sulphocyanide is almost insoluble; but it is only formed in a solution containing an excess of a powerful reducing agent, such as sulphurous acid or ferrous chloride. But the process is cumbersome; requires much skill and attention; and depends for its success on the recovery of the copper from the precipitate. Naturally there must be a certain loss in this operation; and the higher the price of copper the less are the chances of its paying its way. But even were it possible to remove the sulphocyanides successfully, there would be still left the phenoloid bodies whose oxygen absorbing properties are equally objectionable.

These considerations have led me to work out a method by which the production of effluents can be altogether avoided. In the first place, the ammonia liquor is distilled by means of steam in the same stills as are used at present, but with this difference —that no lime or other alkaline substance is added. The resulting liquor contains all the fixed salts of ammonia, besides tar oils and phenols, and other inorganic salts. We will assume that we carbonize 100 tons of coal daily, and that the total quantity of liquor leaving the still is 5000 gallons per day. The moisture contained in the coal and such of its hydrogen compounds as yield water on distillation, will produce about 10 gallons of water per ton of coal—*i.e.*, 1000 gallons per 24 hours. If we have used a quantity of steam equal to 500 gallons of water for distillation, we find that out of the total quantity of 5000 gallons, 1500 gallons are freshly formed every 24 hours. It is evident that the remaining 3500 gallons can, after cooling, be used again in the scrubbers for absorbing a further quantity of ammonia and ammonia compounds, and that we shall only have to dispose of 1500 gallons—*i.e.*, only three-tenths of the quantity we should otherwise have as an effluent—in such manner as to avoid a nuisance. But it must be borne in mind that when the operations have been carried on for some time (say, 14 days), this three-tenths in bulk would contain the same amount of impurities as would otherwise be spread over the larger bulk—*i.e.*, they would be three and one-third times as objectionable to the river authorities.

Whatever be the quantity of liquor thus obtained, it must be evaporated to a small bulk to become amenable to further treatment. It may be generally taken that the ultimate bulk after evaporation will correspond to about 1¼ gallons for every ton of coal carbonized. It will then form a strong solution of ammonium chloride and thiosulphate, besides containing some thiocyanate, sodium chloride, and possibly some ferrocyanide. Ammonium chloride can at this stage be removed to a considerable extent by cooling and crystallizing; and as some of the samples which I have examined contained up to 20 per cent. of the total ammonia going to the stills as ammonium chloride, the recovery of the ammonium chloride as such should yield considerable profit.

The remaining mother liquor will now contain chiefly thiosulphate, chloride, and thiocyanate. This liquor is placed in a still and neutralized with weak sulphuric acid, so as to decompose the thiosulphate. After agitation, such a quantity of sulphuric acid (or more) of about 120° Twaddel is added as would form ammonium hydrogen sulphate with the ammonia contained as thiocyanate. On heating to about 100° C. (or less), and agitating, the thiocyanate becomes partly decomposed, and partly distils over as such. On passing the gases through limestone, a pure solution of calcium thiocyanate is obtained; hydrochloric acid not being liberated if the temperature and other conditions are followed out as directed above. After passing the calcium carbonate absorber, the gases are taken through a mixture of an iron salt with alkali, or oxide of iron, and in either case sulphuretted hydrogen and cyanogen compounds other than thiocyanate are removed.

The liquor from this still, which contains ammonium sulphate, chloride, and free sulphuric acid, but no thiocyanate, may be used for diluting the sulphuric acid which is used in the saturator. It will, however, in existing installations probably be better to use a separate saturating box built of stone for this liquor, and take part of the ammonia from the main into it, so as to avoid any chance of the lead in the old saturator being attacked by any hydrochloric acid which may be set free. In new installations, the ordinary saturator would serve the purpose if made of material which will resist hydrochloric acid, always provided that it were found that the liquor coming from the sulphocyanogen still attacked lead.

One great advantage of the method which I propose is that it enables us to recover all the cyanogen compounds, without interfering with the present plant, and without special washing apparatus. Two ways are open for this purpose. Where the quantity of these compounds is large, they may be removed as insoluble ferrocyanides or zinc ferrocyanides by adding ferrous or zinc sulphate in the exact proportion (to be previously ascertained by test) to the evaporated liquor and neutralizing carefully with sulphuric acid. After filtering, the liquor may go to the still, and be treated with a further quantity of sulphuric acid, in order to eliminate the sulphocyanogen. But where the quantity of ferrocyanide is not excessive, there is no need of any treatment of this kind, as the ferrocyanides will become decomposed in the still in the presence of an excess of sulphuric acid, evolving hydrocyanic acid which will be absorbed in the alkaline iron or in the oxide of iron purifier, and thus allow of the recovery of these compounds in the shape of ferrocyanide.

Looking at the process from the commercial point of view, it will be noticed that a new product is obtained—viz., ammonium chloride—which, at corresponding tests for ammonia, is 25 per cent. more valuable than sulphate. Apart from this gain, which alone amounts to from 9s. to 13s. per ton of ammonium sulphate produced, we have a saving in not using lime, which amounts to 3s. per ton of ammonium sulphate, a saving in the quantity of steam used, and the amount of labour should be the same as before. There should be a gain in the yield of ammonium sulphate equal to about 4s. per ton, as no ammonia left in the waste liquors from the stills is eliminated from the system. There is a gain through the recovery of thiocyanate and ferrocyanide, which, taking them at only 1d. per lb., would amount to from 4s. to 20s. and more per ton of ammonium sulphate. Against this probable saving of from 20s. to 40s., we have to allow for the cost of evaporation, the cooling of the liquors, and the amortization and depreciation of the extra plant required. The only serious charge among these items is that for evaporation; but as I have succeeded in designing a cheap and effective form of evaporator, which can be worked on the principle of multiple evaporation, this charge—particularly in gas-works—would not be more than from 1s. to 2s. per ton of sulphate of ammonia. In coke-works where the amount of liquors produced is excessive, the charge for evaporation will be larger; but it may be taken that in gas-works my process should show considerable additional profit on each ton of sulphate of ammonia, and in coke-works a very fair one. In both cases, it will at the same time do away with the troublesome question of effluents, which in gas-work may at any time arise, and which in coke-oven works has already become one of vital importance.

But although this process does away with the nuisance arising from effluents, and at the same time yields a considerable extra profit, there are many cases in which a process requiring no alterations in the old method of sulphate making, but still doing away with noxious effluents within certain limits, would be more acceptable. With this object in view, I have designed a second patented process which yields an effluent which in all but exceptional cases will be found satisfactory, At the same time, it requires no alteration in the old way of sulphate making; hardly any additional outlay; and although the extra profit is not as large as in my first process, it will still be sufficient to cover all expenses, and leave in most cases a fair margin. Briefly, the process is as follows: The crude liquors, as soon as possible after leaving the washers or condensing towers, are mixed with such suitable compounds as will produce insoluble ferrocyanides from the cyanide of ammonia, and these can be settled out and purified. In this way, the formation of sulphocyanides is prevented, and the effluents are practically free from these compounds. The extra gross profit from the ferrocyanides recovered will, on an average, be about 8s. per ton of sulphate of ammonia.

In studying matters connected with chemical processes, we find that the tendency of modern legislation is in the direction of sanitary improvement, and manufacturing methods must submit to their restrictions, which in many cases –notably in the Leblanc soda industry—have proved not only beneficial to the public, but even more so to the manufacturer. Sooner or later, no doubt, where it has not already done so, this tendency will affect the gas manager.

The PRESIDENT said he was sure the members had all listened with great interest to Dr. Grossmann's lecture; and he asked Mr. Hollinworth to open the discussion upon it.

A varied discussion then took place, in which Messrs. Hollinworth, Glover (St. Helens), Woodhead, and Clayton took part; Mr. Glover recommending to the Juniors Dr. Grossmann's new book on "Ammonia and its Compounds."

Mr. S. E. HALLIWELL (Littleborough) said it gave him great pleasure, as an old Junior and a young Senior, to be present at the lecture, which had been one of intense enjoyment to all of them. He congratulated the Council on the new step they had taken in instituting these lectures, which he thought was a good move in the right direction. He proposed a vote of thanks to Dr. Grossmann for the instructive lecture he had given.

Mr. DUDLEY (Oldham) seconded the motion.

Dr. GROSSMANN, in acknowledging the vote, said he was greatly obliged to the meeting for the very patient way in which they had listened to his lecture. It gave him pleasure to come among the Juniors; and it had been a further pleasure to him to see that the Seniors had come and shown their appreciation of the movement the Juniors had inaugurated.

# SOUTHERN DISTRICT GAS ASSOCIATION.

A general meeting of the Association was held at the Hotel Cecil, Strand, W.C., last Thursday—the PRESIDENT (Mr. F. W. Cross, of Lea Bridge) in the chair. There was a large attendance of members, drawn no doubt by the interesting character of the *agenda* that they had received with the notice of the meeting.

The minutes of the last meeting having been taken as read, the members at once proceeded to the

### ELECTION OF OFFICE-BEARERS.

The PRESIDENT said he had much pleasure in proposing for the presidentship for next year a name which he was sure would be welcome to all the members. It was that of Mr. Harold Woodall, of Bournemouth. It was a pleasure to the members to have Mr. Woodall's father presiding over them a few years back; and it would give equal pleasure to the members to have his son following in his footsteps. With the knowledge of what Mr. Woodall was doing at Bournemouth, he was sure they would look forward to his year of office with great pleasure and profit to themselves.

Mr. T. GLOVER (Norwich) seconded the motion with the greatest of pleasure, as he was sure it would commend itself to the Association in the very best way. He did not think they could have a better President than Mr. Harold Woodall for the coming year—partly because of the great work he had been doing at Bournemouth, and the opportunity he would no doubt give the members of seeing the unique work there.

The motion was carried with acclamation.

Mr. J. W. HELPS (Croydon) said he had great pleasure in proposing that Mr. Norton H. Humphrys be elected Vice-President for the coming year. He (Mr. Helps) had known Mr. Humphrys for a great many years—not only as a member of this Association, but also as a member of the old South-West Association, of which he (Mr. Helps) was also a member many years ago. Mr. Humphrys had the interests of the Association entirely at heart; and he was sure they could not choose a better man for the office.

Mr. J. T. JOLLIFFE (Ipswich) seconded the motion, which was carried unanimously.

Mr. R. BEYNON (Torquay) proposed that Messrs. J. D. Ashworth and G. R. Love be elected members of the Committee in place of those retiring by rotation.

Mr. W. WOODWARD (Bromley) seconded the motion; and it was heartily agreed to.

Mr. S. Y. SHOUBRIDGE (Sydenham) moved the re-appointment of Mr. J. L. Chapman and Mr. A. Dougall as Auditors.

Mr. A. W. ONSLOW (Woolwich Arsenal) seconded the motion, which was unanimously carried.

Mr. W. D. CHILD (Romford) moved the re-election—if he would kindly consent to accept the office—of Mr. A. F. Browne as Hon. Secretary and Treasurer. He was sure the members would be completely satisfied if they could retain the assistance of such a zealous and efficient officer.

Mr. NORTON H. HUMPHRYS (Salisbury) seconded the motion, which was cordially agreed to.

### NEW MEMBERS.

The HON. SECRETARY announced that the applications for membership were as follows: Mr. T. Berridge, of Leamington; Mr. J. N. Reeson, of Beckton; Mr. S. W. Ibbotson, of Newport (I. of W.), and Mr. P. G. Moon, of Bournemouth.

Mr. D. H. HELPS (Reading) moved that the gentlemen named be elected members of the Association.

Mr. J. PATERSON (Redhill) seconded the motion, which was unanimously agreed to.

### THE END OF THE NAPHTHALENE INVESTIGATION.

The PRESIDENT said the members had all received a copy of the final report of the Special Committee on the naphthalene investigation. It was, of course, a lengthy matter; and the whole history of the inquiry had been put in book form, which he was sure would be of great interest to the members. He should call upon Mr. Price to read the report.

Mr. W. E. PRICE (Hampton Wick), the Chairman of the Naphthalene Committee, said it was not altogether with pleasure that he got up to read the final report of the Committee, because the termination of the investigation was not exactly in accordance with their desires. But, as the report told them, this was due to circumstances over which the Committee and the Association had no control. The naphthalene inquiry commenced in 1901, and closed this year. The history of the investigation, with the report and accounts, had been brought together in a book, as it was thought that the inquiry was of sufficient importance to be preserved in this way.

The report read by Mr. Price, with other extracts from the interesting volume referred to, are reproduced on pp. 521-5.

### MR. THOMAS GLOVER ON THE COMMITTEE'S WORK.

Mr. T. GLOVER (Norwich), in moving the adoption of the report, said the request to propose the motion was only handed to him a few minutes before, and therefore he had not prepared anything to say to the members. However, he thought they must all feel that their thanks were due to the Committee for the patient work they had done; and they all appreciated the ability that Dr. Colman had brought to bear upon the work throughout the course of this great investigation. He noticed in the report that the Committee appreciated the fact that their work was incomplete, and had not achieved the results that they hoped to attain. Whether one attained an object or not, depended upon what one set out to do, and as to the practicability of the object. The fact that the Committee had not attained the object meant that they had set before themselves an extremely high ideal; and he did not think that the Committee were to be blamed because the report was not as conclusive as they would have liked it to be. Towards the end of the report, the Committee said: "With this end in view, the Committee began by studying the conditions existing at various works as to the cooling and condensing of the gas, and the effects produced thereby on the naphthalene and other vapours contained therein. They hoped in this way to discover a method by which the gas could, with certainty, be completely deprived of naphthalene by the time it left the condensers, under all the varying conditions prevailing in different works; or if this should not be found possible, to arrange the condensation so that the gas should carry forward sufficient vapours of light hydrocarbons, other than naphthalene, which would combine with the naphthalene and precipitate it in a liquid instead of a solid form." They had to take this statement into consideration in connection with one in the report of Feb. 29, 1904*: "The determination of the amount of vapours of 'light oils' present in the gas along with the naphthalene, and also of the percentage of such oils present in the tar at each works, shows, however, a marked difference in the two sets of works. . . . It will be seen that, in the main, the quantity of these substances, both as vapour in the gas and as liquid in the tar, is decidedly higher at the works free from naphthalene deposits than at the others; this being especially the case with regard to the xylene fraction boiling between 130° and 170°." He thought this latter quotation threw light on the question, and was really at the bottom of the fact that the Committee had not been able to arrange the condensation so that it would with certainty, under all the varying conditions existing in the works, either extract the whole of the naphthalene or leave in the gas the vapours of the light oils which would, on cooling, condense with the naphthalene. In fact, if the Committee started with condensation, they had not started far enough back. They could not hope to arrange any condenser—any conceivable form of condenser—that would remove all the naphthalene, or leave in the gas that which it had not got. The gas must contain something before they could leave it in; and the gas in some works where they were very much troubled with naphthalene, had not the vapours of the light oils which they wished to have present in the gas. He had had this confirmed just recently. He was asked for information with regard to some tar which the tar distiller had found extremely difficult to distil. The tar distiller reported that the tar had no light oils in it; and it had so much naphthalene in it that it blocked up the condensing worm, unless the condensing worm was kept very hot. What was wanted in the tar was in the retort. He was not the first to say this; and he was not claiming any originality. He believed it was said to him originally as one of the unworthy workers ["No, no"] in this matter in the early stages. They wanted to find out the causes of producing naphthalene; and he thought they now knew more about it than they did formerly. The secret of the fact that some works using Durham coal were troubled with naphthalene and some were not, was found in the different ways of carbonizing. This being so, they came to the point that they must depend upon some extraneous help for the removal of the naphthalene; and this they also knew much more about than they did. They naturally knew practically what was set out in the paper that Mr. Young and himself were responsible for in 1897—that, if they could add to the gas, either at the condenser or at later stages, the vapour of light oil and naphtha, it should condense at the same temperatures as naphthalene on cooling, and there would be no trouble. The Committee had had a high ideal, but because of the extreme difficulty (as he had pointed out) of the variation of the method of carbonizing, they had not been able to give the members such a conclusive report as they would have liked. They attempted an almost impossible thing; but the Committee deserved all praise for the way they set to work, and the conclusions they had come to. In the days to come, when they had attained the ideal method of carbonizing, the naphthalene difficulty would disappear at the same time, and that was the time to aim for.

Mr. J. TYSOE (East Greenwich) seconded the motion, which was unanimously carried.

The PRESIDENT said he should like to add to the remarks of Mr. Glover that the thanks of the members were due to the Committee for their work in this matter, as well as to Dr. Colman. Of course, the report that had been read by Mr. Price did not fully set out the work of Dr. Colman, whose latest report would be found in the volume sent to the members. It was very valuable reading, notwithstanding that the Committee and Dr. Colman had not solved the whole question of the naphthalene trouble.

* See "JOURNAL," Vol. LXXXV., p. 766.

He was sure, however, that members on reading the report would gain some information that would help them in their work, in small ways, if not absolutely, to get rid of naphthalene.

The report was then unanimously adopted.

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The PRESIDENT observed that the first paper was by Mr. G. R. Love, of Guildford, and it was with great pleasure that he had to announce the presence of the Chairman of the Guildford Gas Company (Mr. F. F. Smallpiece). In listening to the paper, the members would esteem the presence of Mr. Love's Chairman among them.

Mr. G. R. LOVE (Guildford) then read the following paper on

## EXPERIMENTS WITH VERTICAL AND INCLINED RETORTS.

When asked by the President and Secretary to give you a paper on my experiments with vertical and inclined retorts—in amplification of my remarks on the papers read by Messrs. Glover and Körting before the Institution of Gas Engineers—I agreed to do so, not for the purpose of advertisement, but because, when making these experiments, I found that the whole ground (according to the records of the Patent Office) had already been covered by former experimenters. But, as far as I could find out, very little was recorded as to the failure of these patents (as not being

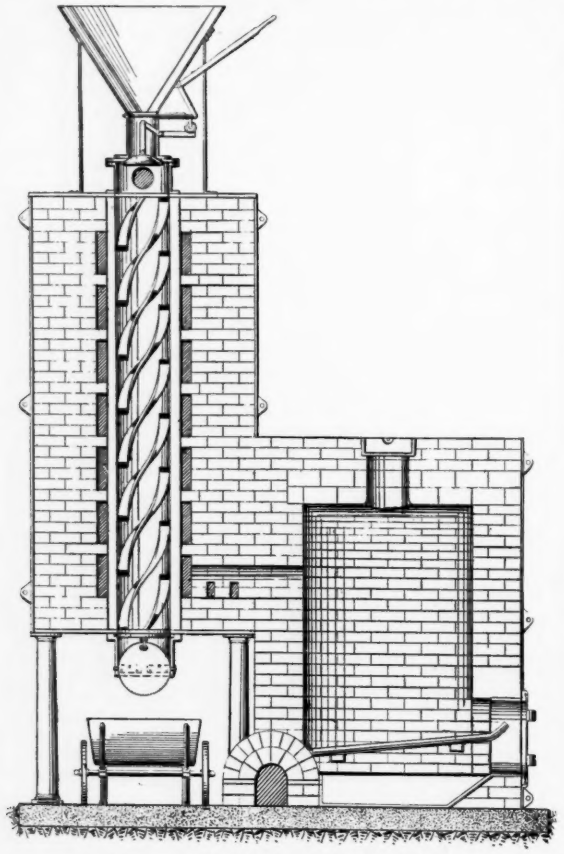

**Fig. 1.—Love's Vertical Spiral-Fed Retorts.**

in operation one must conclude that they had failed); yet what they did do, and how far their work was a success or failure, the members of the gas profession have no opportunity to judge, or to work upon, in following in their footsteps. Such knowledge would have been of the greatest help to me in my work, and would have saved me numberless trials. So, in giving you my notes, I do so with the desire of adding to the general stock of information, and by this means lightening the labours I hope of future experimenters.

The first trial was made with a single vertical retort, 10 feet long and 15 inches internal diameter, having four spiral vanes running from top to bottom, and standing out about 3 inches—thus reducing the space across to 9 inches diameter. These vanes were for the purpose of carrying the heat of the retort to as near the centre of the mass as possible. The retort was built in four pieces, and had a taper of 4 inches on the 10 feet length. Fig. 1 shows a section of the retort and the oven in which it was built. As you see, it was supported on four columns; the bottom plate forming the outlet mouthpiece as well as the bed for the oven. Alongside is a regenerative furnace of the usual type, connected to the oven by a flue which formed the combustion chamber—the secondary air being let in on each side by a series of ports. The mixed gases were led in at the bottom, and round the retort in a series of chambers, so as to give them as long a travel as possible, and keep them from running too soon away to the chimney. They were also taken off at the top, and down alongside the furnace, for the purpose of heating the secondary air. On the top and bottom plates were bolted the measuring chambers for charging the coal and discharging the coke. The upper one was of the usual sliding-door and bell-valve arrangement—provision being made for a charge of about 8 lbs. of coal; while the lower one was made with a sliding-door operated by a rack-and-pinion attached to a flap-door. The opening of one door closed the other by one operation. On top of the charging machine, a storage hopper for coal was fixed; while the gases were led to the usual hydraulic main from the mouthpiece underneath the charger, and from thence to the condenser, exhauster, scrubber, purifier, and meter—the whole plant being complete throughout.

When well heated, a quantity of coke was placed on the top of the bottom door, to form a hot bed for any coal falling on; and charging operations were started. Every six or seven minutes 8 lbs. of coal was charged, and this was continued for 2½ hours. Then the discharging door was opened, and a charge of coke taken out every half-hour—this being considered quite enough, as the discharging measuring chamber was much larger than the charging one. At the end of 3½ to 4 hours' working, the heats went down; and the yield of gas, which at first had been far more than was expected, began to drop very low. During the first two hours' working, no tarry vapours were observed; the whole of the tar being gasified. But as the heats went down, and the retort got filled up, tar began to show itself. Also it was observed that while the coke came readily at first, difficulty was experienced in getting it down. Charging was stopped to allow the heats to rise, and the coal to be worked off. The gas at first was of poor quality—being little over 10 candles, and the yield being over 14,000 cubic feet per ton. But as the retort got filled up half way and above it, the yield per ton decreased, and gas of 15 candles was steadily maintained. Many experiments were made with the object of finding the height at which to keep the retort charged that would give the best results. If too deeply charged, the coke would not fall out, and the heats went down; while if three-parts of the height was left empty, the quality went down and lamp-black troubles began. Not being at all satisfied with these results, I had the mixed gases led in at the top of the retort, and taken away to the regenerator at the bottom—thus reversing the method of heating. I intended by so doing to prevent the overheating of the gases in the upper portion of the retort, by reducing the empty space; in other words, to have the retort at least three parts full.

It was found on working the setting, that the top of the retort was certainly hotter, and that we could get better results in the yield of gas per ton by heating the top of the retort first. But still we had trouble with the spent charge. The coke would not drop, but adhered to the sides of the retort, becoming moulded to the exact shape of the inside of the retort. Thus when we got it out (and it was in large lumps) one could easily see the shape of the vanes formed on the coke. I tried charging the retort in smaller quantities, till 1 lb. per minute was reached. I also tried charging the retort with one charge of 4½ cwt. of coal, and allowing it time to work off. Still the same difficulty was met with. The coke would not come down without some considerable trouble. One thing, however, I had found, and that was that more gas per ton was given off when the retort was charged in small quantities than in large ones; that to charge the retort full in one operation was not so profitable—in yield and quality—as in quantities of 7½ lbs.; and that 1 lb. to 1¼ lbs. per minute gave by far the best results. This conclusion was forced upon me after many trials.

The trouble with the coke being so great, I made up my mind to do away with the vanes in the interior; and so they were cut out, and trials made without them. But here it was found that the heats could not be maintained. The fuel account was increased by enlarging the draught upon the furnace; and still sufficient heat to thoroughly carbonize the coal continuously day and night could not be got. The retort was certainly about 3½ inches thick over the body, due to the fillets at the bottom of the vanes; but as the fuel account was over 25 per cent. of the coke produced, and sometimes 27 and 28 per cent., I did not think it profitable to proceed with this retort.

This one was therefore taken out, and an oval retort, 22 inches by 15 inches and 10 feet inside measure, was put in place of it. This retort was about 2¾ inches thick throughout, with a taper of 3 inches in its length. The bottom of the retort was heated first, during the earlier experiments; while the later ones were made with the heat being applied first at the top of the retort. With this retort I made many trials, putting in 1 lb. and 1¼ lbs. of coal per minute—8 lbs. every six minutes, and increasing the quantity each charge with a corresponding increase in the time between the charges. I also charged the retort from the bottom to the top, and let it work off, so as to see which gave the best results in quantity and quality of gas. I further wanted to see under what condition the coke could come down best—whether in small quantities every half-hour or at longer intervals. At the same time, I took note of the quantity of fuel used in the furnace. The best results were obtained, as with the former retort, when the smaller quantities were charged. The quality of the gas was more easily kept almost without variation of quality; and if the heats could be maintained, the yield was also more even.

Certainly the largest yield of gas was got when the body of the mass was low in the retort; but the evils flowing from gasifying the coal so low down in the retort were great—viz., the forma-

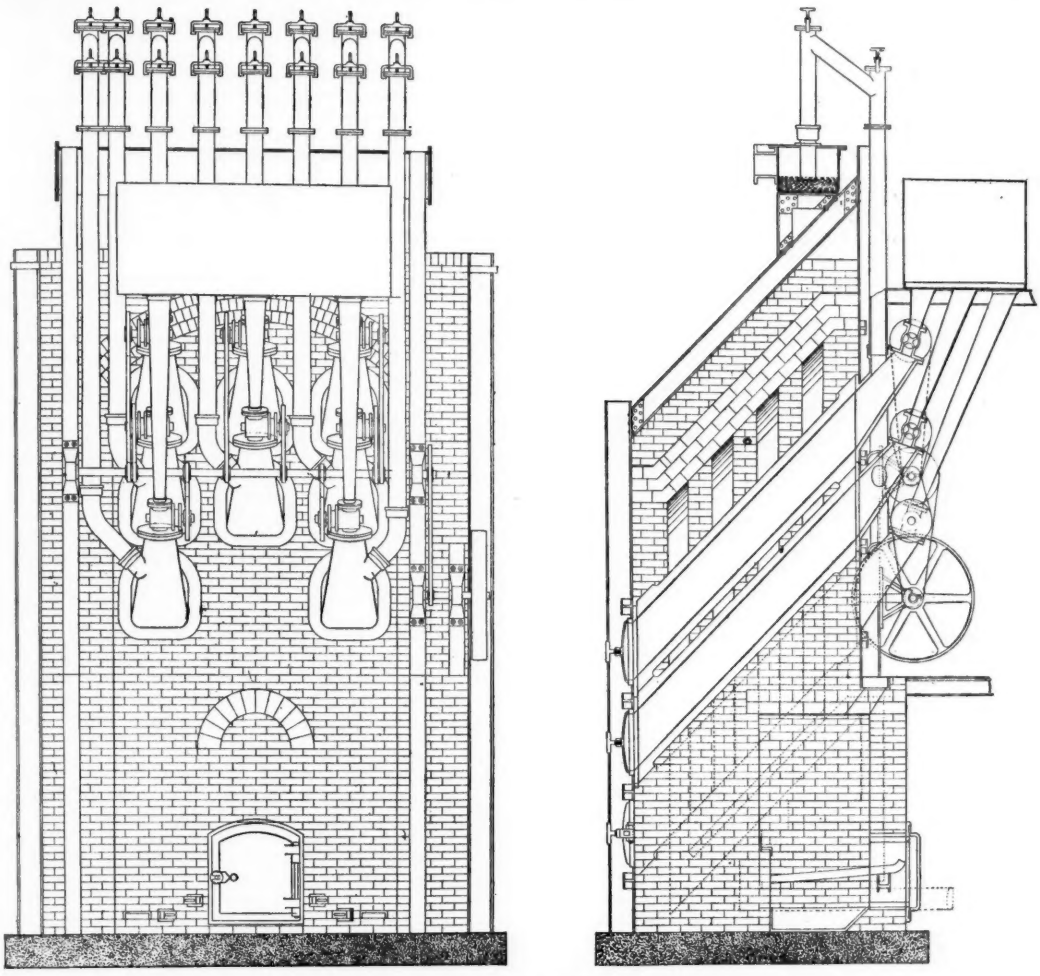

**Fig. 2.—Love's Setting of Self-Feeding Inclined Retorts.**

tion of soot or lamp-black in all the plant and the cleaning of this out, with the loss of gas during the operation—that, to my mind, it was more profitable to have a little tar keeping the pipes moist than to gasify all the tar. Therefore, everything considered, it was found best to keep the retort charged well up, or nearly full if possible.

But here another trouble presented itself. The coal on top was not carbonized, and became pitchy—caking into one mass on the top, and causing considerable back-pressure, also at times keeping the coal from falling from the charger into the retort. The heats, too, were difficult to maintain for constant working. In fact, nearly every day the plant had to be shut down till the heats were worked up, and the coals thoroughly spent; and so I found that with the plain retort less trouble was had with the coke dropping when thoroughly spent. But this pitchy mass on top would not drop, and could not be pushed down without a lot of labour, as one could not get all round the outside of the mass to free it from the retort. Thus more fuel was needed to get the heats, and keep them, than with the spiral retort first used.

From these experiments, extending over many months, I felt that I could not say that I had improved upon the results obtained with a good setting of horizontal retorts. I was, therefore, reluctantly compelled to abandon the vertical retort, for carbonizing coal and making coal gas pure and simple. I knew well the advantages to be gained by the introduction of steam or blue water gas at the bottom of the retort—that I could increase the yield per ton of coal, and also bring down the coke more readily. But I also knew it would be at the expense of the illuminating power; and as we used only a second-class Durham gas coal, and our standard is 15 candles, no liberties in this direction could be taken.

Before leaving the vertical retorts, and giving you an account of my further experiments, let me gather the results obtained in their use. I found that 12,000 cubic feet of 15-candle gas could be got from Durham gas coal, by charging the coal in small quantities (but the bed had to be shut down to allow the heats to come up every twelve hours); that the fuel account was over 26 per cent. of the coke produced; that the coke would hang up; and that one could not readily get at the inside of the retort to scurf or repair it.

Just at this time the results obtained on the trial retort at Exeter, along with the design of the retort, were published. These results very naturally, in view of my own partial failure, gave me considerable food for reflection, as they said that they could get continuous carbonization day and night with coal only, without the use of steam or blue water gas, while I could not do so. How did they succeed, and why did I fail? There was no difference, practically, in the method of charging. The shape of the retort was certainly different, as the bottom portion was turned outwards for the discharge of the coke. This for a long time I considered would hinder the discharge of the coke rather than help it; but it was possible also that this bend increased the heat of the retort as it came across the flame-bed. The idea then suggested itself to me, that if the coke has to be helped to come down in the vertical, why not increase the height of the existing inclined retorts so as to make the coals creep down the retorts at a slow speed, feeding them at short intervals, and discharging the coke only when fully spent.

To put this idea to a practical test, I had the 22 inch by 15 inch oval retort put over from the vertical position until it had an angle of 60° with the horizon—using a furnace of the same size and shape as those used in the vertical experiments. The lower end of the retort rested on the top of the furnace, just over the charging door, so that when required the hot coke dropped into the furnace. The retort was carried upon vertical piers over the combustion chamber which ran from one side of the bed to the other. The gases thus played on the underside of the whole length of the retort, round the sides and top, and then down to the regenerator.

This retort gave me more uniform results than I had obtained from the verticals. Certainly, the coke had to be tickled and closely watched; so that the portion not fully worked off was allowed to remain in the retort. But the saving in fuel was considerable; and the ready means of access to the interior of the retort was a great relief, as well as the fact that it could be worked right through the 24 hours without stopping.

The results obtained from this retort were so encouraging that it was resolved, with the consent of my Directors, to erect a bed of eight retorts on the incline, and thus test under ordinary every-day working what really could be got from it.

As will be seen from the diagram fig. 2, the bench erected is of the usual inclined type, having the retorts coming through each side of the bench, while the gases are taken off the upper or charging end and led to the hydraulic main on top of the bench. The retorts, eight in number, are ∩ shaped, 22 inch by 15 inch and 10 feet long, all inside measure. This shape I preferred, as being easier to build, and presenting a flat surface to the coal sliding down. And here I may say that a retort 22 inches by

9 inches or even 8 inches would be better, and more of them in the oven, than the ones set at first, and would give higher results. The angle at which they were built is 45°. This I did to bring the retort more across the flame-bed, and also because the coal at 60° came down too rapidly. Opportunity was taken of the underside of the angle of the retorts to place the furnace on that side. This was done because I had no head-room in the retort-house, and could not go down owing to water, and also to be out of the way of the barrows on the discharging side. The mouthpieces on the discharging side have only a facing-strip on them, to which is fitted the door with lever and screw. These on future ones should be hung from the top, not from the sides as at present. The charging mouthpieces resemble fiddle-hams, being apered from the full size of the section of the retort to 6 inches in diameter. They are set at an angle of 75°, to keep the coal from lying on the mouthpiece. On top of the mouthpiece is bolted the charger, which at first was a hollow ground cock, 4 inches in diameter, provided with a stuffing-box for the spindle coming through, and on which is keyed the sprocket-wheel for driving same. The whole eight are connected up by chains to countershafting, so as to reduce the speed from the engine to one revolution per minute. The charger puts in 1½ lbs. of coal every revolution. The coal-hopper overhead is connected up to the chargers by means of shoots.

The working of one retort by itself, with the personal attention it receives, is one thing; but it is quite another to build a bench of retorts, put it into the ordinary day's work in the retort-house under ordinary conditions of working, and receive the usual attention. Results in the first case are always much higher than in the second, and my experiences are no exception to the general rule. The results obtained from this bench on many occasions were very disappointing. For one shift of twelve hours things would go well; the next shift everything seemed to go wrong. The free space on the top of the coal was the biggest trouble with these retorts, as with the vertical. If very high heats were carried, and a large empty space left above the charge, trouble came in the shape of lampblack, and the chargers were difficult to drive. Very often they had to be taken out and scraped, so as to relieve the load on the engine. On the other hand, if the heats were let down too low, the quantity of moisture in the gases affected the coal in the chargers, and the coal would not drop out—getting pitchy and revolving round in the chargers until dug out.

The first of these difficulties was overcome by having the retort two-thirds full, and taking out the coke at shorter intervals and in smaller quantities. This, of course, necessitated more labour. The second difficulty was overcome by altering the form of the chargers, and making them in the form of blades so that each pocket was V shaped—the ends being the only binding place. Much better heats were obtained and these, with the fuel account kept much nearer that obtainable on horizontals. From 15 to 17 per cent. of the coke produced was the quantity used; the only drawback being that as the furnace was not on the discharging side, it was necessary to bring the coke around, and as (being experimental) we had no hot-coke conveyor, the coke would be quenched before putting it in the furnace.

The working of a bed of retorts with a constant feed is to my mind a very pleasing sight. No sound, no smoke, nothing to suggest that anything is going on but the quiet motion of the chain-belts moving slowly round—not at all like the usual glimpse one gets of Inferno when entering a retort-house. Here I speak of the charging side only. On the discharging side, as I have it arranged, the usual scene is witnessed of hot coke being withdrawn from a retort. But this is only momentary, as small quantities only are taken out. Even this could easily be avoided, as it could be arranged to discharge the retorts also continuously, though this would necessitate the closing in of the only means of viewing the interior of the retort, as the discharging end would have to be kept gas and air tight.

With this bed of retorts, I also tried various quantities of coal being charged into them. I tried charging the retort full of coal, putting in about 5 cwt., and working this off before discharging. The coke obtained from these charges was much better than was got from the coal when fed constantly into the retort; but the yield of gas per ton was not so high, nor yet did we get nearly so much per mouthpiece per 24 hours as when constantly feeding in small quantities. In fact, the efficiency of the 10-feet retort, when fully charged at one operation, is no better than the ordinary horizontals; while, on the other hand, putting in (say) 1½ lbs. per minute (which I have done many times in each of these retorts) works out at 19 cwt. per 24 hours per retort 10 feet long. But when we did this, the quality of the coke was not satisfactory. This I attribute to the length of the retort; and should I build retorts again on this principle I would make them not shorter than 15 feet, as the longer the coal is kept in the retort the more compressed together it gets, and the harder it becomes.

When I speak of the coke being inferior, I mean that we got the coke out in long thin flakes, tapering from about 2 inches in thickness to almost ⅛ inch; and this on falling on the floor or barrow made a lot of breeze. The coal charged into the retort was very fine, having been passed through ½-inch mesh before being elevated to the coal hopper.

For some time I worked this plant into the foul main running round the retort-house, along with the gas from the other retorts, and taking the increase over the former average daily makes to represent the quantity got from the new bench. But as this was a very variable quantity, and quite unreliable, I had a separate plant erected, so that I could ascertain accurately the make and also the products from this bed alone. These results I need hardly enter into here; but, roughly speaking, the quality of the gas when the retorts were fairly set going was very constant—certainly more so than with horizontals. The yield of gas per ton was about 1000 cubic feet better than I usually get; the weight of coke was less; the yield of tar was considerably less; and the yield of ammonia a little better.

When I started these experiments, it was to find if I could erect in a low and rather narrow retort-house, a bench of retorts on the regenerative principle which would give me as good results as I was obtaining in another retort-house, without alteration of the structure, and (as stated before) without having to go lower down than the present foundations because of water. In this, I have succeeded to my entire satisfaction; for not only have I erected a bench of retorts on the regenerative principle, but I can in a given space carbonize 50 per cent. more coal and get a higher yield than I can do elsewhere.

*Discussion.*

The PRESIDENT said he was sure the members had listened to Mr. Love's paper with the greatest pleasure; and he did think that the perseverance shown by Mr. Love in carrying out these experiments marked him as (what should he say?)—a Scotsman. For right through the paper they could see the perseverance of the man in having set before himself an object, and trying to attain it; and, as he said at the end of the paper, he had attained what he went out to seek. Not only did they appreciate Mr. Love's efforts and perseverance, but he thought, in listening to a paper of this kind, they could but appreciate the great assistance given to Mr. Love by his Directors in carrying on work of this sort. They all knew that it was to Boards of Directors that they must look for assistance in prosecuting experiments of this nature, and in bringing them to a successful issue. In the "JOURNAL" last week, there appeared a long list of articles and patents on vertical retorts; and it occurred to him while this paper was being read what an immense amount of work had been expended on the question of vertical retorts. If only a portion of the work that Mr. Love had put in here had been expended on many of these patents, it appeared to him that such work must end in a good result.

Mr. HAROLD W. WOODALL (Bournemouth), called upon by the President, said he was afraid he had little to say that would be of any value. After listening to this excellent paper, he was in a position to appreciate the troubles that Mr. Love must have experienced; and he certainly felt most grateful to him for the friendly and frank way in which he had put before them the history of his work. A good many of them made mistakes; but not all of them were willing to publish them. Mr. Love started with many troubles, but apparently he overcame them; and he was to be congratulated for the perseverance and courage which took him through. It was a difficult thing very often to know what was coming out of an experiment. Starting on one line, unfortunately one found, as one went forward, the experiment developing on altogether different lines to what were anticipated. They all must appreciate—the profession did appreciate—the kindness of Directors who made it possible for engineers to carry out such work as Mr. Love had done. Unless Directors supported their engineers when they wished to make progress, it would be quite impossible for the industry to go ahead; and in these days, with the competition they were meeting right and left, and in more than one branch of their business, it did become essential for them to make progress. The Association, they had heard that day, had done what they could to assist in progress in one direction. Mr. Love could not have had a more appreciative audience in recounting the efforts he had put forward, and which were so successful in improving the position of the industry.

Mr. T. GLOVER (Norwich), also called upon by the President, said he was reluctant to speak again; but, as he was responsible for bringing a paper before the Institution of Gas Engineers last June, it might be expected that he should say a few words. In the first place, he noticed that Mr. Love found that small charges gave the highest yield of gas; and regarding this he (Mr. Glover) did not suppose any of the members were greatly surprised. What they were surprised at was that their friends on the Continent believed in such a big charge, and were content not to get away from the evils of the admitted shortcomings of their present system. That was where English practice on verticals was going to chiefly differentiate from Continental practice of persisting in emptying completely a retort and filling it up again. He was astonished to find that Mr. Love regarded the difficulties as so great that he departed entirely from the vertical retort and went in for the inclined, although his inclination was 45° or 60°, and that he did not persevere—rather he did persevere a great deal; but they would all be sorry that he was not able to bring the vertical retort to a successful issue. He noticed particularly that Mr. Love said he found a high yield of gas when the vertical retort was not filled to the top. He (Mr. Glover) did not want to enlarge upon that too much, because he had already said enough about the matter of radiant heat; but this did seem to point to a confirmation of the theory he himself was responsible for at the Institution meeting, that they must not, in their new developments, get away from the importance of radiant heat. He felt this very strongly. He hoped it would soon be proved, and that Mr. Woodall would be able to tell them something about it when he gave them particulars of the Bournemouth vertical retort system. Mr. Love found something

else. He found he had great trouble through the formation of lamp-black and pitching-up when he used too much radiant heat; and they could understand that this would be the case, seeing that he had no arrangement for filtering out the lamp-black before the gas entered the hydraulic main. In the case of the inclines, they noticed that Mr. Love took off the gas before it came to the coal-feed. He had trouble also when he got above a certain temperature. One could not help but feel that he had far too much radiant heat in the inclines, especially if he was only getting such a thin layer of coke as he mentioned—only 2 or 3 inches tapering down in some cases to ½ inch. Only a part of the retort was occupied with the charge; and the gases from such a layer of coal must be subjected to far too much radiant heat; and not having any arrangement for filtering out of the gas the lamp-black, they could understand that Mr. Love's ascension-pipes and hydraulic mains would become choked. These were some of the points he wished to suggest for Mr. Love to discuss in his reply; and they might guide them in their developments of the vertical retort system. He hoped that gas engineers in England were going to take their part in the developments of the vertical retort. He believed along this line lay development in the near future. They all admired the way Mr. Love had worked at this subject, and the manner he had brought it before them.

Mr. A. M. Duckham (Bournemouth) observed that, after Mr. Woodall's reference to the paper, he had not much on which to remark. He should like, in the first place, to say how much he appreciated the paper. What Mr. Love had gone through, he thought Mr. Woodall and himself had also experienced. They could imagine Mr. Love sittting on that 10 feet of retort, and seeing the coke not going down. As to the vanes in the retort, of course now they knew they were wrong; and the reason they were wrong was that the coal got into a mass, and simply stuck in the vanes, and when it carbonized, it carbonized on the vanes. He could appreciate the amount of punching Mr. Love had to put into the retort to knock the coke away. They had trouble in this way with small obstructions at Bournemouth, through faulty construction of the retorts, which gave a great deal of trouble at times in the early stages of the experiments in trying to get the coke through. With these vanes, they would want a strong man on the top of the retort-bench, with a strong rod to get the coke out. Mr. Love also made some remarks about the fuel consumption. Where experiments were being made with a single retort as in this case, it was hard to criticize fuel results. There was a retort all alone, and with cold air all round the setting; and the fuel was being used for heating one retort only. Fuel results ought therefore not to be criticized too severely with a single retort or a single bed. He did not agree with Mr. Love in saying that a better heat could be obtained with sloping retorts than with verticals. With vertical retorts, they could get just as good heats. It was only a matter of the form of setting; and once the setting was right, the heating of the vertical retorts, in his (Mr. Duckham's) opinion, was very much simpler than the heating of inclines. He understood Mr. Glover to say that Mr. Love got his best results when the retort was quite full.* He (Mr. Duckham) believed that Mr. Love said he got better results as the retort got fuller; and he was inclined to work the retort more or less full. He thought this was reasonable, for if there was any large space above the coal in the retorts, the gas was subjected to rather bad treatment in going through the space; and they did not get such constant conditions if they worked at a varying line in the retorts as they would do by working the retort up to a point. Mr. Love made a remark as to the heats going down after the retort had been working for a time. He (Mr. Duckham) did not think that this was the fault of the retort, but that the producer was not large enough. If Mr. Love had bigger flues or a bigger producer, he thought he would have got his heating all right, and would not have had to shut down at certain times. He could quite imagine the author's trouble with lamp-black; but he (Mr. Duckham) did not believe in making lamp-black. Neither did he believe in having to filter it out, as Mr. Glover proposed. If they made lamp-black, they got horrible things like naphthalene, and all sorts of trouble. Mr. Love also talked about trouble with scurfing the retorts. He sympathized with him in this, because the first retort at Bournemouth was somewhat similar to the one shown in Mr. Love's drawing; and it was rather awkward, when it was necessary to take off a coal-hopper for scurfing the retorts. The flame came upward; and it was not pleasant for the men to work with arrangements like that without suitable mouthpieces for getting at the inside of the retort. He quite agreed with another point in the paper. To have a vertical retort working continuously was quite a pleasant thing. The Bournemouth Gas and Water Company had built at Poole a retort-house, which embodied the latest ideas in retort-houses; but it was the most satisfactory thing he ever experienced in his life to see the filthy mess that was made there, and then to go back and see what was being done with the verticals. There was something to be said for verticals yet. If they saw a De Brouwer or any other machine at work, and then went and saw the verticals—witnessing the coal passing in at the top, and the coke coming out at the bottom—it was a very pleasant sight. Mr. Love had referred to constant work. It was a most desirable thing to get absolutely constant work of the whole process. If they got constant work, they reached ideal working; and that was a most important thing.

* Reference to Mr. Glover's remarks will show that Mr. Duckham misunderstood him.—Ed. J.G.L.

Mr. Norton H. Humphrys (Salisbury) said it would be within the memory of the members that some time ago he was requested by Mr. Padfield, of Exeter, to give attention to the results that were being obtained with an experimental retort that was being tried at the works there. That retort had generally been spoken of as a vertical retort; but it was not entirely vertical. The top part of it was vertical, while the bottom (say) one-third of the retort was inclined at about 45°, which gave it a different shape to one entirely vertical. Mr. Padfield found he was able to get with this retort considerably more gas than was usual from the coal he was using. This was Somersetshire coal, which ordinarily yielded about 10,000 cubic feet to the ton. Mr. Padfield was, from the same coal used in this retort, able to get 12,000, 12,500, and 13,000 cubic feet of gas; and the point that he asked him (Mr. Humphrys) to examine was the yield of gas it was possible to obtain by working in the manner indicated by Mr. Love, with small charges. The results were published at the time in the "Journal" and elsewhere; and so they need not be repeated. One thing he might mention was that the setting was very well heated. Mr. Love had referred to the difficulties he had in keeping up the heat. In his (Mr. Humphrys') experiments—extending to over 24 hours in one case—with the Exeter retort, he did not remember there was any difficulty whatever with the heat. The retort was heated with a regenerator setting somewhat similar to fig. 1; but he thought it was a more open setting, with not quite so much travel to the flues. It was an excellent setting; and it heated the retort well, without difficulty. They certainly found that, to get a large make of gas per ton, the best way was to charge in small quantities. The plunger was arranged in connection with the retort so as to put in from 1½ to 7 lbs. each delivery; and he believed they took at the time the middle course, and let down about 4, 4½, or 5 lbs. each charge, to get the results published. In experiments of this kind, he found the pressure on the retort must receive attention, because if they chose to run the exhauster too freely, particularly with small charges, they could show almost any make. It was necessary to see they were getting coal gas, and not furnace or other gases, and this was particularly true with a retort that was getting bad. In the experiments at Exeter, they were particularly careful to see they were always working at a level gauge. If anything, a pressure of one-tenth was worked all through; and the experiments he felt should be conducted without the slightest amount of vacuum. He believed the experiments carried out under his supervision were perfectly satisfactory in this respect; and the results reported were coal gas—*bonâ fide* coal gas, and no furnace gas. The results so far showed that it was worth while to consider the advisability of taking small coal, and using it in vertical or partly vertical and partly inclined retorts. He regarded Mr. Love's inclined retort at 45° or 60° as quite first-cousin to the Settle-Padfield retort, which was partly vertical and partly inclined; and he thought there was something in having an inclined section, at the bottom half of the retort at any rate. It facilitated the discharge of the coke; and it enabled the used-up portion of the charge to slide out, and then the discharge could be stopped.

Mr. S. Y. Shoubridge (Sydenham) asked whether the inclined setting was working now. One of the previous speakers said it was a success. He hoped it was. He could quite believe that, in designing the vertical retort shown in the drawing, the author imagined a "vain" thing. (Laughter) The inclined retort that he had exhibited was still a long way behind the inclined retorts in use before in other places. Mr. Love said he obtained an increased make of 1000 cubic feet per ton; but he found a falling-off in other respects. He therefore wished to know whether Mr. Love was continuing the use of the retort. He should also like to thank the Directors of the Guildford Gas Company for their kindness in allowing Mr. Love to make these experiments. They were setting a good example to other Gas Directors throughout the United Kingdom; and he hoped the Directors at Guildford would allow the author to go on and experiment still further, both with the vertical and the inclined retort.

Mr. D. H. Helps (Reading) said there was a question or two he should like to put to Mr. Love. First of all, he noticed that the coal he used was passed through a ½-inch mesh sieve. Using such fine coal, did he find any gap between the coke and the coal, or rather the partly carbonized coal? In regard to Mr. Glover's remark as to radiant heat being so important, he could not himself see how radiant heat could play such a very important part in the vertical retort. Mr. Love, when he had the vanes in the vertical retort that prevented the coal coming out, recognized that conducted heat was of more importance than radiant heat. Why did Mr. Glover place so much importance on the question of radiant heat, because surely heat could not be better applied by radiation than by conduction?

The President, in bringing the discussion to a close, said he thought one point had been lost sight of by the speakers. In connection with the results that Mr. Love was getting from these inclined retorts, the trouble he had had, it appeared to him (the President), was that he had not been able to get the coal in a sufficient layer in the retort. The author only had 2 or 3 inches to ⅛ inch thickness of charge in the inclined retort; and Mr. Glover had pointed out the effect of the radiant heat upon such a thin layer of coal. There, he thought, was to be found the cause of the great trouble that Mr. Love had had in getting regular working. He had not been able to get the necessary regular layer of coal in the retort; but when he had devised apparatus by which to get regularity, he (the President) thought the results would be very much

better, especially in the absence of lamp-black and so on. He considered this was a point Mr. Love had to work upon. At the same time, he was sure all the members appreciated Mr. Love's kindness in bringing before them the results of his work.

Mr. Love, replying to the discussion, said he had to thank the members for the kind way in which they had received his effort. He had given a plain statement in his own plain, blunt way. He had not tried to embellish it in any manner, nor had he tried to keep back from the members any of the difficulties he had had. He had to thank Mr. Woodall especially for his appreciation of his work. Those of them who had gone through this kind of thing could sympathize with one another in the troubles they had had. He (Mr. Love) had not told the members anything like all the troubles he had encountered in connection with this matter. Mr. Glover had spoken about him having gone from the vertical, and discarding it altogether; and naturally both Mr. Woodall and Mr. Glover (who was also interested in a vertical retort) did wonder at him leaving it. The members would readily understand that these gentlemen were approaching the matter from quite a different standpoint. He (Mr. Love) started with the idea of making coal gas only. He might be wrong in his opinions; but he could freely express them. He believed that coal gas for the supply of the consumers was the best gas; and so in his experiments he had worked along lines to try to produce the greatest quantity of gas from coal and coal only. Enrichment of any kind was not so good to his mind as gas obtained from coal. Hence his reason for going from the vertical. The lamp-black troubles were certainly very great; and the loss due to these troubles was also very great. They knew that, if they had a large empty space above the coal in the retort, a larger yield of gas could be obtained. There was no doubt as to that fact. The gas was split up into the constituent parts; and a larger volume of gas was obtained. That had been his experience. But why did he come to the conclusion that a vertical retort was not so profitable as an inclined one? And in answering this, he would reply to Mr. Duckham as well as to Mr. Glover. If they put in a charge (say) 6 inches deep into this 15-inch retort, they presented to the heating power of the furnace only the edge—a 6-inch edge—of the coal. That was to say, supposing this [picking up a book] was a mass of coal going into a vertical retort, the heat applied to it would only be round the edges; and they would get the thickness only exposed to the heating surface of the furnace. Supposing they put this same amount of coal into an inclined retort, instead of only getting a heating surface of 6 inches, they would get a heating surface of (say) 15 inches; and, consequently, they were bound to use less fuel in heating the coal along this larger area than they would in the vertical retort. He thought this proved his contention that they were bound to use more fuel in heating a vertical retort than in heating an inclined one. In reference to what had been said as to the fuel used in an experimental bed or for heating a single experimental retort, he thought at Guildford they came pretty near to what would be experienced in ordinary working. In the inclined setting, in fact, he did get to just about what they would use ordinarily; and the quantity of fuel used there was very much less—about 50 per cent. less—than what he was using in the heating of the vertical retort. The furnace gases passing round this vertical retort were well spent before being taken away to the chimney. It had been suggested that he anticipated trouble when he put the vanes in the vertical retort—or, at least, ought to have anticipated trouble. However that might be, the vanes proved to him that, with a vertical retort and vanes of this kind, he could carbonize his coal with less expenditure of fuel than he could with a plain retort, because the vanes carried the heat nearer the centre of the mass. Then there was still another matter that made him abandon the vertical retort; and he had dwelt on this before. It was that they could not see the interior of the vertical retort. Any of the members who had tried to patch the producer of a water-gas plant when it was hot would know something about the troubles of looking over the top of a vertical retort when hot. Personally he thought if they could not see the interior of their retorts, it was a great loss to the manager in working. Because of this, he abandoned the vertical retort; and what was more, if they could get the same results from inclines, could see through the inclines from each side, and have the top free, he could not see why they should build verticals, which he did not think could be built cheaper than inclines. With reference to the back-pressure on the retorts that Mr. Humphrys spoke about, he found, as he stated in the paper, that if they had a greater pressure in the interior of the retort than the weight of coal coming down, the coal would not fall out of the charger. He found this on many occasions when working the experimental retort on the incline. Several times he found that the coal would not drop down; and he found it was due to the pressure in the interior of the retort. He also found, if they worked with exhaust upon the retort, there was the greatest difficulty in maintaining the illuminating power. He had never got an absolutely tight retort; and they would, if they put a vacuum upon the retort, pull in furnace gases, and this would reduce the illuminating power. In reference to the lamp-black, Mr. Glover seemed quite hopeful that, if they passed the gas through some medium, they would eliminate the lamp-black. His own experience had been that, if the gases instead of going away below the charger, were taken off above the charger and got in among the coal, the coal would not drop down. It would revolve round about, and become of the consistency that it would not go down. And if it did this in any case where only a small proportion of the gas made came in contact with the coal, what about passing the whole of the gas through the mass of coal that was intended to slide down into the interior of the retort? It would become so coated with tarry matter or pitch that it would stick, and would not fall down. Over and over again, he found this. Many times in the vertical retort he had taken off the top to examine the coal, and had found it like dough—just a plastic mass. He could put a rod into it, and the rod would go down, and would come up and the mass close in again. But it would not go down from the portion near the top of the retort where they were losing heat by radiation. Therein trouble lay. In his opinion they had better work with lower heats, take less gas out of the coal, and work with a little tar than no tar at all. Mr. Shoubridge asked him if the inclined retorts were still working, and were the results satisfactory? At the present time, they were not working. They had a storm in July which blew the roof off the house, and the retorts had not been working since June. They were in a position to work, but there was no elevator for raising the coal. He could here answer the question put by Mr. Helps. The coal had to be elevated up by a bucket; and it had to be passed through a riddle, and broken up fine. All this entailed labour. To work the bed of eight retorts, he had employed two men, and another man to break the coal for the day and night shifts. The cost of doing this was too great, and so they did not work it constantly. If his Directors, in their wisdom, erected further beds of these retorts, then the system would be very profitable to work, because the same men could work two or three beds. But so far as the results were concerned, he had no hesitation in saying that it would be to the advantage of his Company to erect these retorts as compared with the others. Some remarks were made about the coke. The reason why the coke came out in scales as mentioned in the paper was that the coal naturally formed itself into layers each charge; and if on the discharge of coke at the bottom, too much was taken out at one operation, the upper layer loosened itself, and slid down over the coke formed on the bed of the retort. He had pointed out that a great many of his difficulties were due to the fact that the retort was 10 feet long. If it had been a 15-feet retort, he would not have had all these troubles, because the coke at the bottom of the retort was always large. It was only when they got near the top, and took too much out at a time that the coke came down in scale form. He was certainly deeply indebted to the members for the kindly way in which they had received his efforts.

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Mr. James Paterson then read a paper, entitled

## BIG MAKES PER TON.

Before entering upon the subject-matter of this short paper, I desire to make two explanations, which will in the first place show my excuse for addressing you, and secondly will place before you the reason for my choice of a subject. (*a*) I conceive the object of a paper read before the Association is as much to put into action a lively and useful discussion, as to communicate new experiences and experiments; and it is hoped that the subject is one that will appeal to each and all of us in that desirable manner. (*b*) The "Big Make per Ton" is a subject that is essentially one of the present time; and I hope shortly to raise a clamour of objection and refutation to the points that shall be put before you.

During the last fifteen years at Redhill, the yield of gas per ton of (Durham) coal carbonized has been steadily increasing—having risen from 10,142 cubic feet in 1890 to 11,142 cubic feet in 1905. These figures, it must be explained, are "balance-sheet" figures, and not taken from the carbonizing book. The increase, which is not claimed to be in any way unusual or record-breaking, has been due to a variety of circumstances, which probably find a parallel in many other works in the country, of our comparatively modest size.

Now, how has this increased yield been obtained? By one of two means, or both. Increased exhaust on the foul main, or increased heat in the settings. The first cause, looking at it in a broad sense, can at once be put down as improper working. Gas should certainly be taken away from the retorts as fast as it is made; and therein lies the secret of successful carbonizing. On the other hand, the slightest "pull" below atmospheric pressure in the retort must result in a drawing-in of furnace gases, to the detriment of both the calorific value and the illuminating power of the gas.

It will be noted that I omit the good results obtained by the use of governors in the retort-house, which by their action, produce a steady, constant exhaust on the gas. Our improved yield has not been obtained by such apparatus.

The second method is by increasing the temperature at which the coal is carbonized; and that is probably the means by which the extra 1000 cubic feet of gas per ton has been secured.

Now, the prime object of this paper is to endeavour to show that an increase of yield from 10,100 cubic feet to 11,100, or 11,500, or 12,000 cubic feet, cannot in all probability be obtained without considerable expenditure and loss in other directions, and to raise the point whether these do not counterbalance, or even negative, the comfortable "extra gas for nothing," as it has been off-handedly called. Shortly, are "Big Makes per Ton" worth the candle?

I wish to make it clear that I do not definitely say that so many of us are searching after a vain thing; but I have wondered whether the cost has been counted, and it is hoped that as far as this meeting is concerned, a majority view one way or the other can be secured.

The point, as it occurred to me, is that in Redhill we do not seem to be reaping any tangible benefit, as between 1890 and 1905, in the cost of manufacturing gas per 1000 cubic feet. There are so many obscuring factors—such as cost of coal, rate of wages, allocation of comparable charges, price obtained for coke, and so on—that the question cannot be solved in our case, at any rate, by reference to working data of the past. I will therefore take a specific example, and follow it out on probable lines, to see if after all there can be any doubt as to the ultimate utility of this important tendency of modern practice.

To the credit side of the account we set the extra 1000 cubic feet of gas produced from a ton of coal. This, with coal at say 16s. per ton on the charging-floor, amounts to a saving (between 10,142 and 11,142 cubic feet) of 1s. 5d. per ton. Carbonizing wages per ton remain, of course, the same. Now against this, there are many things which may perhaps have to be placed on the debit side. It is the discussion of these items to which your attention is invited, to see, first, whether they deserve a place at all, and secondly, whether their sum-total amounts to, or exceeds, the 1s. 5d. gain per ton of which we are so far definitely assured.

It is well to reiterate here that a saving of 1s. 5d. per ton, which is about 1½d. per 1000 feet, has been taken as a specific instance arising out of the trend of our Redhill practice, and that other gas undertakings may show now, and in the future, far larger and more appreciable differences.

The debatable items above referred to are as follows:—

Possible loss of available ammonia.
Possible smaller yield of tar.
Possibly more fuel used in the furnaces.
Lastly, increased wear and tear of settings.

(1) With regard to ammonia, Mr. Lewis T. Wright has pointed out that the yield of ammonia from coal is lower at high heats than at medium heats; and consequently it is probable that in the example I am putting before you a lower yield of sulphate per ton of coal would be obtained when the make is 11,142 cubic feet per ton from Durham coals. Wright's figures, which were published in the "Journal of the Society of Chemical Industry,"* were for a Midland coal; and he found sufficient variation in the ammonia produced at various yields per ton, to justify my query as to similar variations in gas produced from North Country coals, under the conditions of this example. If there is a parallel variation, we may expect a loss of between 1 lb. and 1½ lbs. of sulphate per ton of coal carbonized. Taking the net profit at £7 per ton, we have a loss of from 0·75d. to 1·125d. per ton.

(2) Tar. The production of tar at higher heats might be supposed to be less than at lower heats. But in the comparatively small range that we are considering, there does not seem any noticeable difference in our Redhill figures. And it is to be noted that Mr. Butterfield says: "The quantity in the gas at the outlet of the condenser should not be greatly affected by the heat of the retorts."

(3) Coke used in furnaces. It is undoubtedly true that, to maintain a high temperature in the retorts, more fuel must be used than would be necessary with a lower temperature. Here, again, comparative figures are not available, though possibly some have been published bearing on this question. It is sufficient for my purpose to point out that, with an increase of as little as 1 per cent. in coke used, there is (with coke bringing in a net profit of say 15s. per ton) a loss of 1·2d. per ton of coal carbonized; for an extra 2 per cent. used in the furnaces, 2·4d.; and so on.

(4) Wear and tear of settings. Higher heats in the settings must, of necessity, accelerate the inevitable wearing-out of the brickwork. This is again a condition that it is almost, if not quite, impossible to reduce to comparative figures. Suffice it to mention it as another item operating on the debit side of our statement of profit and loss.

Thus I have briefly reviewed the arguments for and against the policy of increased yield of gas from coal, at any rate as exemplified in the conditions of practice at Redhill.

On the one side there is shown to be a saving of 1s. 5d. per ton on the coal; on the other side a possible 0·75d. lost on decreased ammonia production, a possible 1·2d. lost on the extra coke consumed in the furnaces, and an unknown (but perhaps small) loss due to increased wear and tear of the settings. On the face of it, there seems every reason to believe that this extra 1000 cubic feet of gas is very largely to be counted a valuable net gain, which must cheapen the cost of production.

Unfortunately, as mentioned above, I cannot trace that we in Redhill have produced this desirable result; and this brief inquiry has not, so far as I can see, given a clue to the solution.

How does the case stand, if we are considering still greater differences of yield of gas? What is the condition of affairs when we are making 11,500 or 12,000 or more cubic feet per ton? It is obvious that, at high yields, the illuminating power begins to suffer, and if a statutory standard is fixed, adequate enrichment must be used.

It is possible that very high yields are not really economical; and in any case it is certain that for any given coal, carbonized in a suitable setting, there must be a fixed amount of gas to be produced from a ton of coal, above which, or below which, it is not ultimately economical to deviate.

The whole condition of affairs demands very careful consideration, if we are actually going to show an improvement in that stern and uncoloured summary of our manufacturing operations—the "Manufacture of Gas"—in the revenue account.

* See "JOURNAL," Vol. LI., p. 281.

*Discussion.*

Mr. THOMAS GLOVER (Norwich) asked, with reference to the 1s. 5d. shown as the value of the extra 1000 cubic feet of gas per ton, whether the value of that should not be worked out, not on the 16s., but on the 16s. less the residuals that would be made by the extra coal used.

Mr. PATERSON: I do not think that is very important.

Mr. A. VALON (London) said that, when he heard the first part of the paper, he was inclined to echo the hope expressed by Mr. Paterson that he would raise a clamour of objection and refutation to the points of the paper; but after hearing the conclusion of the paper, he (Mr. Valon) was not so sure it would do so, although he did not agree altogether with the method by which Mr. Paterson arrived at his result. However, he did cordially agree with him that there was a considerable advantage from an increased yield of gas per ton of coal carbonized. Mr. Paterson's difficulty seemed to be that he could not trace his saving in the balance-sheet; and he thought Mr. Paterson quite truly said there were so many disturbing factors that it was very difficult to find any specific advantage between one year and another. But he (Mr. Valon) believed there was another explanation, in that he made his calculations "per ton of coal carbonized." Now it was all very well to make calculations at "per ton of coal carbonized" where the make of gas was constant; but when the make of gas varied, they brought in a factor which rendered "per ton of coal carbonized" erroneous, and grave errors were likely to arise. For instance, take Mr. Paterson's very first item, which he called, he thought, "saving in gas, an extra 1000 cubic feet of gas produced." This was hardly a saving in gas. It was a saving in coal—that was to say, it was not a saving in gas per ton of coal, but it was a saving in the coal between what it used to cost him to make 10,142 cubic feet and what it now cost him to make 11,142 cubic feet. It was quite clear that if he paid 16s. per ton of coal on his stage, it did not matter how much coal he used, or how little—he would still pay 16s. per ton of coal carbonized. The coal would cost just the same. If he used a less quantity, he would in the aggregate make a considerable saving; but instead of calling that coal the author put it down to gas. When they came to the next item, carbonizing wages, the author again said that, of course the carbonizing wages per ton of coal would remain the same. Quite true. The carbonizing wages would certainly remain the same, but not in the sense that he had used the words "per ton of coal carbonized" in the previous item. It was quite clear that, if they increased their make by 10 per cent., their carbonizing wages per ton of coal remained the same. But in the aggregate the carbonizing wages were reduced by 10 per cent., and the total carbonizing wages were reduced per 1000 cubic feet of gas made, which was an important point. He thought that perhaps he had said enough to show the difficulty of using that method of calculation in such a way as this. But he would like to say a few words with regard to the specific items of saving and loss which Mr. Paterson had mentioned. First going back to coal. Mr. Paterson said there was a saving there of 1s. 5d. per ton calculated on the 16s.; but, as Mr. Glover had pointed out, this calculation should be on the net cost of the coal—that was to say, if they used less coal, they had less residuals, and they lost the income from them. So that only the net cost of the coal was saved after deducting the residuals. With regard to carbonizing wages, in addition to the savings he had pointed out, if, by means of higher heats and yields they could do the carbonizing in fewer retorts, they did decrease the carbonizing wages in this way, because, within working limits, the carbonizing wages depended upon the number of retorts it took to carbonize a given weight of coal. Next came the possible loss of available ammonia. Here he agreed that, from the laboratory experiments, a manager would expect to find a loss of ammonia by the higher heats. In his (Mr. Valon's) experience, he had never been able to trace that loss. Whether or not it had been hidden up by other factors, he did not know; but he had not been able to find it. Recently he was looking carefully through the accounts of one of the London Gas Companies; and he found that they had in late years steadily increased their make per ton. But the ammonia produced varied between the same limits as before; and when the highest quantity of gas was made, the yield of ammonia was highest also. With regard to tar, he agreed with Mr. Paterson. As to the fuel used in the furnaces with high heats, they must use more fuel per ton of coal; but if they obtained a higher yield of gas, they might still use less fuel per 1000 cubic feet of gas made. That was to say, unless they increased the fuel in greater proportion than they increased the yield, they would have a comparative decrease in the fuel. In regard to wear and tear, it looked at first as if higher heats should mean greater wear and tear; but, in his experience, this had not been so. After all, if they had good materials and good workmanship, and a fair margin between the temperature in the setting and the fusing or the softening point of the materials, he did not think the extra temperature in the settings should make a difference to their life. At two gas-works which he had had under control, they had the

same settings, the same workmen kept them in repair, and the same materials and coal were used. But in one works the make per ton was 10,000 and in the other 11,500 cubic feet; and over a considerable period there was no apparent difference in the repair and maintenance of the settings in the two works. Then there was one other item which Mr. Paterson had not mentioned—that was the interest on outlay. If they had a bigger make in any given size of retort-house, they reduced their capital outlay, and the interest was consequently reduced. He should like to suggest to Mr. Paterson that, if he had any doubts as to the higher makes, he should bring down his make again to 10,100 cubic feet per ton for the ensuing year; and then, he thought, the result would be quite obvious in the balance-sheet at the end of the year.

Mr. J. W. Helps (Croydon) said the paper before them was not a long one, neither was it full of statistics; and he did not think it was a very suggestive one. He proposed to start, in a small way, the "clamour of objection and refutation" of certain of the points that had been raised by Mr. Paterson. He thought he might take it that the author believed there were two ways of getting an increased yield of gas; and that he believed they were the only two ways. Mr. Paterson thought he obtained his high make at Redhill by increasing his heats. That was the first point, and it was a very important one, in which he proposed to differ from Mr. Paterson. At Croydon, during the past year or so, they had considerably increased their make per ton; and he thought he could honestly say it had not been at any rate entirely, but to a very small extent, due to raising the heats. There were other ways of getting higher makes of gas per ton. He quite agreed with Mr. Paterson in one statement—that was, that the gas should certainly be taken away from the retorts as fast as it was made; and therein lay the secret of successful carbonization. Two years ago at Croydon, they were making 10,500 or 10,600 cubic feet per ton of coal carbonized. A year ago they were making 1000 cubic feet more. They were using the same coal, or not quite so good, because they had had to give up one of their best coals on account of it being such a sulphurous one. How was it they were getting the increased result? He thought he could fully explain. They used to find, when making experiments on their retort mouthpieces, that they got a variation in pressure and vacuum. They might say that sometimes it was pressure and sometimes vacuum—varying to the extent occasionally of 2 or 3 inches; and he set himself to find how it was they got this result. By going into the matter and fixing automatic gauges, and by very carefully levelling the hydraulic mains and altering the dips, they found it was possible to work with a variation of only 1-10th; and from that time their better results came. They found it was rather difficult to get such an accurate state of affairs inside the retorts; and finally they put on retort governors. He could honestly say, by means of these retort governors, they had succeeded in keeping up the good results they had previously obtained. If one would consider for a moment why this variation of pressure inside the retort had such important effect, it would not be so difficult as it looked. The retort surfaces inside were in a very heated state; and the pressure itself undoubtedly drove the gas into the thousands of little pores of the retorts. And if there should be a slight vacuum, it was drawn out again, but not in the condition in which it went in; and to this was probably due the deposition of carbon on the retorts. Now if the high results were obtained by either of the methods mentioned by Mr. Paterson—viz., greater heats or pull on the exhauster—he should expect to find a diminution of the illuminating power. But he might tell the author that the improved results at Croydon in regard to high makes had been attended by an improvement in the illuminating power of the gas. Not only that, but Mr. Paterson stated—and this was a matter Mr. Valon had referred to—that the carbonizing wages per ton remained the same. Mr. Paterson should consider for one moment what followed from being able to produce a larger make of gas per ton of coal. If the result was obtained in the way he had indicated, and no carbon, or little carbon was formed on the side of the retort, he would get ½ cwt. more coal in the retort. In a 22 inch by 16 inch retort, they were able at Croydon to carbonize regularly nearly 4 cwt. per mouthpiece. By this means they were able to get over 9500 cubic feet per mouthpiece, whereas two years ago they only obtained 7200 cubic feet. Putting this in plain figures, it meant that this winter, if they were only getting the results shown eighteen months or so ago, they would require 30 settings of eights to do the work that they hoped to be able now to do with 25 settings. So it would be seen, from the point of view of carbonizing wages, and also from the point of view of fuel, there was considerable advantage accruing from the bigger make per ton, especially when accompanied by a big make per mouthpiece. With regard to the point mentioned by Mr. Paterson as to lowering the amount of ammonia obtained, he could say they had not at Croydon found any difference in the amount of sulphate of ammonia per ton of coal that they had been able to make; nor did he think they had found any difference in the amount of tar they produced from their coal. Respecting wear and tear, that, of course, followed on what he had said before; but he thought Mr. Paterson ought to remember that, even if high heats were responsible for the increased make per ton, they were able then to employ fewer retorts, and consequently, though the wear and tear might be slightly greater, it was greater on a smaller number of retorts. And he (Mr. Helps) considered this fact might make up for the somewhat higher rate of wear and tear. He was perfectly sure that the makes in a good many works in the country could be raised considerably without increasing to any great extent the heats of the retorts themselves, if only due care was taken to have as regular conditions as possible inside the retorts. One very important point was to see there was no obstruction in the condensers or in the pipes, so that the gas could be drawn away clearly and regularly by the exhausters; and the make of the gas would inevitably increase. There was just one other little point that assisted them very much. Their exhausters were some distance away from the retort-house and the automatic regulator in the retort-house generally worked by a vacuum pipe taken from the end of the condenser which was closed to the exhaust. They found when necessity arose for altering the speed of the exhauster—automatically, of course—that the cause for the necessity had practically passed by before the "message" came to the regulator itself. So they laid a long length of pipe right away from the retort-house itself to the exhauster; and by this means, the moment any necessity arose, the exhauster would answer at once, and they were not pulling when a decrease was required, and *vice versâ*. If trifles in the retort-house were attended to, they might avoid bringing about any of the objectionable results that Mr. Paterson had alluded to in the paper.

Mr. W. B. Randall (Waltham Cross) said the paper was a delightful one to every gas engineer in the room. He should like to ask what was the candle power of the 10,142 cubic feet and the 11,142 cubic feet mentioned by Mr. Paterson, and what burner it was tested by. These points were not stated in the paper; and possibly they were of importance. Mr. Paterson put down 1000 cubic feet as his increased make; but he (Mr. Randall) thought he should put it at least at 2000 cubic feet, and not 1000 cubic feet, because 11,142 cubic feet per ton would be considered, he supposed, a very moderate make indeed. If the author would refer to the Technical Press, frequent allusion was made to productions of over 12,000 cubic feet per ton. He would therefore beg of Mr. Paterson to take credit for an increase of 2000 cubic feet, instead of 1000 cubic feet. [Laughter]. Another point had reference to his possible loss of ammonia. In his (Mr. Randall's) own experience, it was undoubtedly a fact that they worked high heats, as high as they could get them, and they did undoubtedly lose a certain amount of ammonia. But this was counterbalanced by the amount of cyanides they produced. For some years their purification had been carried out at an absolute profit by the high yield of blue. They worked as high as 5 per cent. of blue; and therefore they should set another credit to the big yields per ton for the cyanides, if they subtracted the amount from the ammonia itself. In reference to the wear and tear on the retorts, with higher heats they must expect that. But would it not be as well to consider the material that had to be used in the retorts, and to substitute for the ordinary clay retorts brick retorts made of silica, or brick retorts of fireclay alone? If they adopted high heats, the brick retorts would last much longer, though they would be slightly more in first cost. But this would, he thought, get over the question of wear and tear. Regarding big makes per ton, there was the question of coke; and he would ask them to consider the advisability of taking as their production 14 or 15 cwt. of coke per ton of coal carbonized. Their Techical Press, within the last few weeks, had pointed this out; and if engineers would take this figure and sell 12 cwt. of coke per ton of coal carbonized, it was another factor in the big yields per ton. A previous speaker had pointed out how the yield of gas per ton could be increased by the use of retort governors, and by anti-dips or dry mains. By such means, Mr. Paterson would undoubtedly get another 1000 cubic feet of gas per ton, which would give the subject a more rosy hue than he had given to it in his paper. If, too, gas managers would use gas-engines for motive power, and employ suction gas plant, they would get still higher yields per ton than mentioned in the paper. [Laughter.] In 1903 at his works they produced 11,906 cubic feet of gas per ton, and sold 11,103 cubic feet. Last half year they produced, 12,041 cubic feet, and sold 11,400 cubic feet. If they could only persuade the Board of Trade to grant them the Metropolitan argand burner No. 2—he (Mr. Randall) had reason to believe they were inclined to do this in place of the murderous burner now used for 14-candle gas—they would get 2000 cubic feet more gas per ton than they were now doing. [Laughter.]

Mr. D. H. Helps (Reading) said that, having spent three or four years at Redhill, he should like to say a few words on the points raised in the paper. Mr. Paterson showed an advantage of 1s. 5d. per ton for the increased make of gas as compared with fifteen years ago. But he did not know whether Mr. Paterson was aware that he was selling more coke, more tar, more sulphate, and more gas; and if the result of this was not shown in the balance-sheet, then they must look elsewhere for it. Mr. Paterson was selling 1 cwt. of coke more than was being done fifteen years ago, and he supposed 3 or 4 lbs. more of sulphate per ton of coal carbonized. As to the reason for the increased make of gas, he (Mr. Helps) thought it was not due, even at Redhill, entirely to increased heats, but to the levelling-up of the dip-pipes. He knew that at one time they varied there from ⅛ to 2 inch seal; and too much gas was being taken from one and not enough from another; and this was the secret of the increased yield. In considering the question of carbonizing wages, he thought it better not to take them at per ton of coal carbonized, but at per 1000 cubic feet of gas made. Further, he did not believe Mr. Paterson would have

been able to obtain 11,142 cubic feet of gas from Durham coal, unless he had had a carburetted water-gas plant.

Mr. J. TYSOE (East Greenwich) said he was unable to determine the view the writer of the paper actually took as to the question of big makes. In the first portion of the paper, he said: "Now the prime object of this paper is to endeavour to show that an increase of yield from 10,100 cubic feet to 11,100 cubic feet, or 11,500 or 12,000 cubic feet, cannot in all probability be obtained without considerable expenditure and loss in other directions." But at the end of the paper, the author said: "On the face of it, there seems every reason to believe that this extra 1000 cubic feet of gas is very largely to be counted a valuable net gain, which must cheapen the cost of production." What did Mr. Paterson really believe? He should strongly advise him to accept "face value." His (Mr. Tysoe's) own experience might be of interest, if he gave two or three actual figures bearing on the subject which had come under his own observation at East Greenwich. He would take the year 1901, when low makes were the vogue, and compare it with 1902, and then with 1906. The increases were as follows: The make in 1902 exceeded that of 1901 by 1200 cubic feet; the coke exceeded that of the previous year by 0·4 cwt. per ton; the fuel used for carbonizing showed a decrease of 1·8 per cent.; the liquor made exhibited an increase of 4·2 gallons; and tar an increase of 0·1, which was very small. Now coming to the first half of the present year, the make of gas exceeded that of 1901 by 2100 cubic feet; the coke made, an excess of 0·7 cwt. per ton; the fuel used, a decrease of 2·1; liquor, an increase of 2 gallons; and tar, an increase of 1·33 gallons. These were actual figures obtained on an approximate consumption of more than 200,000 tons of coal in the half year under review. These were, therefore, figures of a somewhat reliable character. As the writer of the paper had stated, there were so many obscuring factors—such as the cost of coal, rate of wages, allocation of comparable charges, price obtained for coke, and so on—that the question could not be solved, in the Redhill case, at any rate, by reference to the working data of the past. They were all in that condition; and they must compare on exactly the same lines to be of any value. They did know they were making extra gas; and someone had said that he who made two blades of grass grow where one only grew before was a benefactor to mankind. He ventured to say that the gas man who made an extra 1000 feet of gas per ton of coal was also a benefactor to the company he served.

Mr. S. Y. SHOUBRIDGE (Sydenham) said they had all been so busily engaged, in these competitive days, in making 2 cubic feet of gas burn where only 1 cubic foot had been burned before [laughter] that they were indebted to the author for bringing to attention the no less important question of carbonization. Gas engineers had been carbonizing coal now for something over a century; and it was a matter for reflection that so little data existed as to what went on in the retort. Probably this arose from the great difficulty there was in conducting experiments without the proper plant. Not very many works in the country were properly equipped to carry out such experiments. Two he did know of that were properly equipped in this way. One was the Saltley works at Birmingham, where Mr. Hack had put up probably the finest experimental works that they had in the industry. The other was at Nottingham; and these were erected by Mr. Lewis Thompson Wright. He would suggest to the gentlemen who controlled these works that they would be conferring a great deal of good upon the industry, and would immortalize themselves, if they would allow these works to be devoted to the investigation of the many moot problems in carbonization. He took it the author was not concerned greatly as to whether it was possible for one manager to improve his results upon what he had been doing by increasing the temperature of carbonization, but he put a hypothetical case before the members as to what was the best way of getting results—whether it was better to get a greater yield of gas and less residuals, or otherwise. But as the author rightly pointed out, there was a point for every kind of coal which must be the best. But that point again depended upon local circumstances. In some cases the residuals would yield a great deal more than in others; and so every case must be decided on its merits. There were many points they wanted to understand in carbonization—such as the effect of heavy charges compared with light ones, the greater length of charges against short ones, and so on, All these points wanted clearing up. He thought Mr. Paterson had done a great good to the industry by calling attention to the subject. It was certainly one that wanted more attention devoted to it than it had received in the past.

Mr. A. F. BROWNE (Vauxhall) said it seemed to him that, for the true appreciation of the very important question which had been raised by Mr. Paterson, they should contrast in their minds the two ideas of "staple product" and "residual product." There was no time on this occasion to take up the subject from that point of view; but he must say he really was astonished that their friend could have any doubt whatever as to the advantage of increasing his staple product by 10 per cent. from a given unit—viz., a ton of coal—even if, at the same time, he had to pay something for it in the shape of reduced residual gain. It was perfectly true that, from year to year, the residuals might vary. They might be up to-day, and down to-morrow. But if they looked into the question over a series of years, surely none could doubt that a steady and maintained gain of 10 per cent. in the staple product could be anything but a blessing. He thanked Mr. Paterson very heartily for consenting to read this excellent paper. It went right to the root of a very practical subject. He (Mr. Browne) was not going to quarrel with the author over the way in which he had chosen to state his problem. It seemed to him—even making allowance for the remarks made by Mr. Valon—that Mr. Paterson had endeavoured to state the problem in its lowest terms, in order that they might most easily get at the heart of the matter. An ounce of fact was worth a pound of theory; and he was really very much interested to discover whether it was the case, with regard to the Company he (Mr. Browne) served, and the works with which he was entrusted, that there was such loss on residual products in face of the fact that the rise in the make per ton throughout the whole system of the South Metropolitan Company had been very considerable. It was always undesirable to go into actual figures; and so he was going to give the members certain ratios, which, so far as the South Metropolitan Company were concerned, would supply an answer to Mr. Paterson's theory, and would send him away a happier man than he appeared to have been, because he (Mr. Browne) thought it would enable Mr. Paterson to make up his mind more surely that he was on the right side, and was doing, and had done, good work for his Company. He would take the make of the South Metropolitan Company in the year 1900, and would call that 100; he would also take the fuel which was used by the Company in that year at 100. Grouped, the first set of figures were as follows:—

*South Metropolitan Gas Company—Average, all Works.*

| Year. | Make per Ton. | | Fuel. | |
|---|---|---|---|---|
| 1900 | 100 | .. | 100 | |
| 1901 | 100·88 | .. | 117·49 | |
| 1902 | 106·54 | .. | 114·54 | Five years' average, 115·75 |
| 1903 | 109·63 | .. | 118·22 | |
| 1904 | 110·54 | .. | 115·37 | |
| 1905 | 111·07 | .. | 113·19 | |
| 1906 to June 30 | 114·70 | .. | 100·09 | |

It would be noticed, proceeded Mr. Browne, that the make per ton last half year was the largest the Company had ever made; but nevertheless they had gone back in the fuel account to the figure of six years ago. It would not have escaped notice that the fuel went up with a bound in 1901. He could explain that. It would be remembered that 1900 and 1901 were the years of very high prices for coal. During that year the South Metropolitan Company (as members knew was the case with the Companies they represented) bought coal where they could get it; and they got all sorts of coal and fuel. This explained why the fuel went up in 1901, while the make per ton only increased nominally. The fuel account had remained up, with slight variations, during the remaining years; but had not increased *pari passu* with the make per ton, because the make per ton had been going up all the time, and had grown from 100 to 114·7. Practically, the fuel had remained stationary for five years; but this year it had fallen to what it was six years ago. He could not explain how this had happened; but these were facts. With regard to wear and tear, the facts were still more extraordinary; but he must keep to his own works for these, because he had not the figures for the other works. He was going to give the ratios of the make of gas per ton, and the amount expended in the upkeep of the retorts—from the coke-hole level to the top of the exit-flues, at the apex of the roof—including, in fact, everything. Again put in tabular form, the figures quoted by Mr. Browne were as follows:—

*Vauxhall Works Only.*

| Year. | Make per Ton. | | Upkeep of Furnaces and Retort-Settings—Coke-Hole Floor to Top of Chimney. | |
|---|---|---|---|---|
| 1900 | 100 | .. | 100 | |
| 1901 | 100·63 | .. | 82·76 | |
| 1902 | 104·07 | .. | 63·36 | |
| 1903 | 108·88 | Three years' average, 109 | 68·11 | Three years' average, 58·19 |
| 1904 | 109·14 | .. | 47·85 | |
| 1905 | 109·03 | .. | 58·61 | |

In the last three years, it would be observed (the speaker continued) that the make of gas had practically not varied from the ratio of 109; and the average of the repairs of the retorts was 58·61 as contrasted with 100 when the make was only 100. This was a very extraordinary state of affairs; and he was putting it to Mr. Paterson as a set-off to what he suggested had happened. The figures had surprised him (Mr. Browne) as they had perhaps surprised many of the members. The possible loss of ammonia had been suggested. It was not to be found in the carbonizing statements of the South Metropolitan Company as a whole. They were making that day as much ammonia per ton of coal as they did six years ago. The quantity of tar produced had perhaps varied—he thought not more than a ¼ gallon, if so much, during the same period. But even Mr. Paterson gave up tar. Under these circumstances, he (Mr. Browne) intended to go on in the endeavour to get as much as possible of their staple product from a ton of coal. It was because it was believed they would get more gas per ton, that they were aiming at continuous carbonization. He for one wished Messrs. Young and Glover, Messrs. Woodall and Duckham, Mr. Love, and others who were working in this direction, the highest possible success in this great problem of the details of continuous carbonization.

Mr. PATERSON, in reply, said he had to thank the members for the kind way in which they had listened to his short and inconsequential paper. Perhaps he ought to confess before he went

any further—in order to save what little credit he might have retained—that the paper was designed more than anything else to endeavour to draw the members out on the general subject of carbonization. He was pleased to say he had succeeded in the attempt. Mr. Valon questioned his method of showing a saving in the coal of 1s. 5d. per ton. That point had been very difficult to show properly. It would undoubtedly have been better if it had been shown as a saving per 1000 cubic feet of gas. It had, however, been contributory to the extent that it did show a saving on coal. He hoped this had been clear—at any rate to the rest of his hearers, if it had not been to Mr. Valon. Mr. Valon had certainly touched upon a point that had been omitted by him (Mr. Paterson); and he thought it was one that was very important—that was, the saving on plant when larger makes of gas were obtained. He might here confess to Mr. Valon and to all the members that he would not take his advice, and would not go back to the make of 10,142 cubic feet per ton. Mr. J. W. Helps had shown the position at Croydon; and the saving they anticipated there owing to the increased production of gas. In his remarks, Mr. Helps had raised the very point he (Mr. Paterson) was hoping would be brought forward. The way to get an increased production of gas was not, in his opinion, to increase the heat of the settings. His view was really contained in this sentence in the paper: "The gas should be taken away from the retorts as fast as it is made." That was unquestionable; and the retort governors seemed to him an excellent way to get the gas away from the retorts as quickly as possible. The increase at Croydon by their aid was 1000 cubic feet of gas per ton, with no decrease in the illuminating power. That therefore seemed to be the right way of doing it. As to the burner they tested with at Redhill, they had unfortunately to supply 15-candle gas; and they had to test it at the 5 cubic feet rate. He should be very glad to see some burner adopted more suitable for the purpose. Another point he would refer to in passing was that the 11,142 cubic feet was a very moderate make per ton of coal. He had not intended to call it large. But he was taking a specific case, and had worked out a problem on those lines. However, he hoped in the future to reach the rates that had been quoted as having been attained; but he had not done so yet. Mr. D. H. Helps, whom he followed at Redhill, had touched upon a point referring to the same question. He had alluded to the levelling-up of the dip-pipes. Mr. Helps had done Trojan work in producing an even line of seal on the dip-pipes at Redhill. But he (Mr. Paterson), in the case he had presented, had had to eliminate all such conditions, as being incomparable. He had had to level the case up to parallel lines; so he had had to go on theoretical rather than practical lines. As to Mr. Tysoe's remarks, he was accepting the "face value" of what they were doing at Redhill, for it was no use going back to the dim past as to what had been done. The members must all be grateful to Mr. Browne for his interesting comparative figures of the results in the South Metropolitan Gas Company. They were highly interesting; but the true value of them remained to be deduced. He did not, at any rate offhand, see—neither did Mr. Browne—the true explanation of some of the figures he had given them. To have them on record was something; and their publication might possibly bring about an elucidation later on. He must repeat that, to his mind, the great point about carbonizing was to get the gas away as soon as possible. Mr. Randall had referred to anti-dips or dry mains. He (Mr. Paterson) had seen a retort-house where there was no hydraulic whatever—where the main was dry, and the bridge-pipes descended into the collecting-main, into which the gas passed and thence to the foul main at the back of the bench. In these works the exhausting was practically perfect; and the gauge varied almost infinitesimally. It was not a mechanical exhauster. That briefly was the answer. He did not say that the results obtained by such an arrangement were due entirely or to any extent to the exhauster; but it seemed to him that the results obtained—satisfactory high makes, and so on—were due to the fact that there was no oscillation; there was no pumping about of the liquor in the main, the gas was taken away from the retorts (the exhauster ran with the gas as fast as it was generated), and from all further heat of the crown of the retort, as fast as it was made. The gauge at these works was a King's; and they were working to hundredths of an inch. These were carbonizing conditions that were nearly ideal. He quoted this example as one within his own knowledge.

### Votes of Thanks.

Mr. D. Irving (Bristol) said he had been asked to move a vote of thanks to the authors of the papers. He did this with the greatest pleasure. He was sure Mr. Love's paper, giving such a practical, frank, honest, and copious account of his encounters with the difficult subject dealt with, had been a most interesting contribution. He also should like to add a word of thanks to the Directors of the Guildford Gas Company whose generosity had enabled Mr. Love to step aside from the beaten track of carbonization, and to wander in the attractive by-paths of the vertical retort. They had also to thank Mr. Paterson for his paper. It was evidently one written with the idea of provoking discussion; for in nearly every paragraph it was sprinkled with something in the nature of what was known as "treading upon the tail of one's coat." The appreciation of the members was shown by the eagerness with which they were ready to join in the discussion of the paper. He himself believed there was a limit to the profitable yield of gas per ton of coal.

Mr. C. F. Franks (Bankside) seconded the motion, which was heartily agreed to.

### The Benevolent Fund of the Institution.

The Hon. Secretary read the letter that has been circulated by Mr. Walter T. Dunn, as Hon. Secretary of the Benevolent Fund of the Institution of Gas Engineers, among the District Associations respecting the obtaining of further subscribers to that fund. Mr. Browne added that the letter had been before the Committee, who had come to the determination that it should be read at the meeting as a reminder to those members of the Association who were members of the Institution of the importance of the fund, and not with the view of inviting any of the members of the Association as such to subscribe, nor to suggest in any way that the funds of their own Association should be devoted to this purpose. It was an appeal to members of the Institution who might be at the meeting, and who were not already subscribers to the fund.

The President emphasized the point that it was not intended, in laying the letter before the members, to appeal to them as members of the Association, but as members of the Institution.

### Advance Prints of Papers.

The Hon. Secretary also read a communication he had received from a member as to the distribution of papers in advance of meetings. Mr. Browne said, if possible, the papers should be sent out in future with the notice of meeting; but if this should be impossible owing to the late receipt of the papers from the authors, members would afterwards be able to obtain them on application. The papers, however, would not be sent out if they were not in time to accompany the notice, as this would entail further expense for postage.

The protracted proceedings then terminated; and "high tea" was afterwards served in an adjoining room.

## Modern Water-Works Pumping.

The members of the Gloucestershire Engineering Society assembled at the Municipal Schools, Gloucester, last Tuesday, to hear a paper by Mr. C. H. Scott on the above subject. The first set of engines and pumps exhibited were those of the Gloucester Corporation at Newent, which were a combination of vertical engines, horizontal force-pumps, and single well-pumps, driven by means of a T-bob; a balance-weight being employed to equalize the load between the up and down stoke. In a more recent example, the adjustable balance-weight had been adopted, so that the load could be equalized at whatever height the water might stand in the well. Mr. Scott said that the larger pumps, which were put in last year, gave a volume of 50,000 gallons per hour, instead of 30,000 gallons as before. He pointed out that the arrangements down the well were matters of vital importance. Nearly all well pumps had too many loose parts; and it always happened that if they got bolts and nuts on the rods or buckets, sooner or later one became loose and dropped into the pumps, often with disastrous results. The firm with which he was connected had done away with every loose piece that was not indispensable. In well pumps they must aim at the greatest possible simplicity, fewness of loose portions, and ease in removing any part of the pumps. It was quite a different matter to deal with a pump on the shop floor, and to do the same when it was under 200 feet of water; and remembering this fact would save many complaints from those who had to deal with a badly-designed pump in a deep well. At the conclusion of the paper, which was illustrated by lantern slides, a vote of thanks was passed to Mr. Scott, who, in acknowledging it, answered several questions put to him on the subject of his paper.

**A New Gas-Meter Card.**—With the view of encouraging gas consumers as much as possible to read their meters, and check the quantity of gas they burn, a new card has been issued by the Kempston Gas Company. The body of it is occupied by four columns—the first being the date on or about which the Company's representative will read the index; and the others being for the meter record, the quantity of gas consumed, and the cash, in the case of a slot meter. The novel feature of the card is that the dates are reversed, so as to help the consumer to test the subtraction. The card is arranged for four years.

**Separation of Tar in Gas-Works.**—A French patent has been taken out by the Compagnie pour l'Eclairage des Villes et la Fabrication des Compteurs et Appareils Divers, of Paris, for a condenser for the separation of tar in gas-works. A horizontally arranged casing, the bottom of which is inclined towards an opening at one end, from which the condensed tar flows into an ordinary tar-pot, is provided internally with a series of vertical partitions. The holes in one plate are not opposite to those in the adjacent plates; hence the gas is obliged to pursue a tortuous course in passing through the apparatus, and the tar is retained by impact against the surfaces of the plates. The sum of the areas of the perforations in each partition is equal to the cross-sectional area of the inlet or outlet pipe.

# THE THERMAL EFFICIENCY AND HYGIENIC VALUE OF GAS-STOVES.

**Report by the Coal Smoke Abatement Society.**

The current number of "The Lancet" contains a long report, accompanied by tables and diagrams, of a series of tests of gas-stoves extending from the 5th of May till the 6th of June last. It is divided into three parts, in the first of which is given a general description of the tests and the methods adopted, as well as of the stoves dealt with; the second contains the results of the tests (presented chiefly in tabular form); while the third is devoted to a general consideration of the results and to a comparison between gas and coal fires. We are indebted to the Editor of our medical contemporary for advance-proofs of the pages containing the report, from which we extract the following particulars.

The rooms in which the tests were carried out were situated round a square court in the new Public Offices, Westminster, and all the rooms were on the same floor and of approximately the same cubic capacity—containing about 4000 cubic feet each. The walls were of brick, unplastered; the floors and ceilings of coke-breeze concrete, laid between iron girders, no flooring boards being in position. Each room had one window, which fitted practically air-tight, and was kept closed, and one door opening into a continuous corridor running completely round the square. The doors were so arranged that they would not close completely, but each had a stop fitted which gave ½ inch clear space on the latch side when closed; thus allowing air from the corridor to enter the rooms. This being the only inlet to the rooms, the corridor thermometer recorded the temperature at the inlet. There was no furniture in the rooms. The flues were all 68 feet high and 9 inches in diameter; being lined throughout with 9-inch glazed stoneware pipe. The conditions were, therefore, exceptionally favourable for obtaining fair tests, since they were alike for all the stoves. Each stove was tested for a period of eight hours continuously; being lighted at 9 a.m. and turned out at 5 p.m. The gas pressure was kept constant at 12-10ths of an inch. The meters used were specially constructed 5-light meters arranged to register tenths of a cubic foot. The flues from the gas-stoves passed through a sheet-iron plate, fixed against the opening of the main stoneware flues, and closing them completely, except the opening left for the stove flues. The entrance of air to the main flues was therefore entirely prevented, except that which passed through the stoves. There were 25 different makes of stove tested.

The tests were directed towards finding out (*a*) the thermal efficiency of the stoves, considered as apparatus for heating the air of rooms; and (*b*) the effect of the stoves upon the air of the rooms thus heated, considered from a hygienic point of view. The first was therefore mainly a question of gas burnt and heat given to the air passed through the room. The second involved an analysis of the air of the rooms for injurious products of combustion. The following data were obtained for the purpose of determining the thermal efficiency: (1) The number of cubic feet of gas burnt per hour during the test. (2) The composition of the gas burnt and its calorific value. (3) The temperature of the air in the corridor whence air was admitted to the rooms. (4) The temperature produced in the rooms under test—(*a*) at the level of 6 feet above the floor and 6 inches from the wall opposite to the fire; (*b*) at 18 inches below the ceiling in the centre of the rooms; and (*c*) at 6 feet in front of the fire and 6 inches above the floor, exposed to the radiant heat. (5) The temperature of the flue gases issuing from the top of the flue, taken by a thermometer hanging in the middle of the flue by a string 6 feet long attached to a cross piece of wire or wood laid on the top of the flue. (6) The percentage of carbon dioxide contained in the flue gases. (7) The velocity of the upward current in the flues as determined by smoke tests. The last two were directed towards finding the volume of the flue gases passed per hour, and from this the volume of air passed through the rooms. All temperatures were taken half-hourly. The thermometers used were tested, their errors ascertained, and the necessary corrections made.

In order to ascertain the effect of the stoves upon the air of the rooms, the following observations were made and tests carried out: Analyses of the air of the rooms were made for (1) carbon dioxide, (2) carbon monoxide, and (3) general impurities. (4) The amount of moisture in the air, as indicated by the readings of wet and dry bulb thermometers, was determined, (*a*) in the corridor or the inlet to the rooms, and (*b*) in the rooms under test. (5) The presence or absence of smell from the stoves was noted. (6) Musk plants were placed in each room, and the effect of the stoves upon them was noted. (7) The ventilating effect of the stoves was ascertained by the smoke test.

The gas supplied was as nearly as possible of the following percentage composition: Carbon dioxide, 1·50; oxygen, 0·26; hydrocarbons (absorbed by fuming sulphuric acid), 4·64; hydrogen, 43·38; carbon monoxide, 15·62; marsh gas, 29·29; nitrogen, 5·31. Its calorific value was 530 or 540 B.Th.U. net per cubic foot.

These explanatory remarks are followed by a description of the methods and apparatus employed in carrying out the tests of the stoves, the results of which are not only fully tabulated, but are accompanied by explanatory notes. The first table furnishes details of a complete series of tests, occupying 33 columns; the second gives particulars in regard to eight of the best stoves tested, and consists of the columns of most importance transferred from Table I.; the third shows the results of the smoke, or velocity, tests; while the fourth presents those of some special smoke tests carried out to determine the influence of different arrangements of flue upon the draught, and brings out the curious effect of the wind. With regard to the last table, it is explained that the first four tests were made on the same stove, but on different days and under various conditions of weather. The next five tests were of a flue which had no stove fitted, but was open to the room. The object was to determine the effect of the wind, and, while it governed the amount of draught in the stoveless flue, it had little or no effect on that in the flue which had the stove fitted. The next test was of a stove under ordinary conditions, having no opening for admitting air to the main flue except through the stove. The next was with the same stove with the plate closing the main flue removed, admitting an induced draught round the stove flue. The two succeeding tests were similar, as were also the last four. They all brought out clearly the enormous difference made by opening the main flue at the bottom.

We now come to the third section of the report, which, as stated at the outset, is devoted to a general consideration of the results of the tests and to a comparison between gas and coal fires; and we reproduce it practically in its entirety.

When the stoves were tested with the bottom of the main flue opened, a very great increase in the velocity of the flue gases invariably was found. Though the volume of air drawn through the room was increased four or six times by admitting air beside the stove flue, there was in no case any noticeable effect upon the temperature of the room. The flue temperatures, which were taken every half hour, also behaved in a curious way. In two of the four stoves thus tested, the flue temperature dropped on the admission of cold air to the flue; while in the other two, the temperature of the flue gases rose on the removal of the bottom plate closing the main flue. The two stoves which had high flue velocities lowered their flue temperatures at the top on admitting more air; whereas the two with low velocities increased their flue temperatures at the top. Keeping in view the fact that, as the flue gases pass upwards, they lose their heat to the sides of the flue, and the quicker the passage up the less heat will they lose, and also the fact that the effect of admitting cold air to the flue, if the velocity of the current is not increased, must be to lower the temperature at the outlet, it will be seen that in these cases we have a combination of both factors—the velocity being increased and cold air being admitted. The explanation is probably that in one case the rise of temperature owing to the quick passage through the flue was greater than the loss by the admission of the large volume of cold air, owing to the shorter time of exposure to the cold sides of the flue. In the other case, the opposite held good; the reduction of temperature owing to the admixture of cold air not being balanced by the advantage of the quick passage.

As to the effect of the wind on the draught, the tests showed that the wind had little or no effect in increasing the draught of a stove, though it was most effective in producing a draught in a flue which had no stove; also the velocity of the current in the latter varied with the wind. This held good for all the stoves tested. There was never any marked difference in the velocity of the draught, though the wind varied very greatly in velocity on different days.

Another point which was investigated was the rate of growth of the velocity of the flue current. It was found that the velocity went on gradually increasing for about one-and-a-half to two hours after lighting the stove, when it attained a fairly steady value, only increasing very slowly after this. This slow increase was, no doubt, due to the warming of the flue; and it coincided roughly with the rise of the flue temperature, which usually rose rapidly for about two hours, and less rapidly after that.

The number of cubic feet of air drawn through the rooms per hour is a measure of the ventilating effect of the stoves. It must, however, be remembered that though this amount of air is drawn through the room in question, it does not necessarily represent efficient ventilation, as there is a tendency for a localized current to be established near the floor from the door or inlet to the stove—the surrounding air not being changed at anything like the same rate. This was demonstrated by igniting about 10 grains of black gunpowder in the middle of the room. As the smoke cleared away, it was seen to linger in the parts of the room out of the direct line of this current.

Turning now to the conclusions which may be drawn from these tests, they may be summed up in a few words as follows: A properly constructed gas-stove, with a flue sufficiently large to carry away the products of combustion, though for constant work more costly than a coal-fire, is quite as satisfactory from a hygienic point of view, and does not in any way vitiate the air of the room; nor does it produce any abnormal drying effect, as is popularly supposed. It will carry off from about 2000 to 4000 cubic feet of air per hour; and this is a valuable ventilating effect. Compared with open coal-fires, the following interesting points appear: It is only in the very largest gas-fires that the calorific value of the

TABLE *giving Particulars Regarding Eight of the Best Stoves Tested.*

| Name of Maker and Stove. | Cubic Feet of Gas Burnt per Hour during the Test (average). | Calorific Value of Gas Burnt per Hour during the Test, in British Thermal Units. | Cubic Feet of Air passed through the Room, reduced to 60° Fahr. | | Time which Elapsed from Lighting Stove until a fairly Steady Temperature was reached in the Room (in Hours). | Rise of Temperature, in Degrees Fahrenheit, from— | | Heat, in British Thermal Units, given per Hour to— | | Percentage of Total Heat of Gas Burnt per Hour given to— | | | Increase in Carbon Dioxide of the Air of the Room above that of the Outer Air (in parts per 10,000). | Carbon Monoxide in the Air of the Room. | Impurities* shown by Reduction of Potassium Permanganate after Two Hours' Exposure in the Room (in c.c. of Centinormal Potassium Permanganate). | Smell in Room. | Capacity of the Room in Cubic Feet. | Cubic Feet of Gas Burnt per Hour per Degree of Rise in Temperature (in Degrees Fahrenheit) from the Corridor (Inlet) to the Room. | Condition of Musk Plants exposed in the Rooms for Same Time. (Condition judged on the same day.) | Cost in Pence per Hour per Degree of Rise in Temperature in Room from Corridor (Inlet). Gas taken at 3s. 1d. per 1000 Cubic Feet. [Best coal fires in last tests worked out at 0·060, per degree Fahrenheit of rise, tested in the same Rooms.] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per Hour. | Per Cubic Foot of Gas Burnt. | | The Inlet or Corridor Temperature to the Steady Temperature of the Room. | The Steady Temperature of the Room to that of Flue Gases at the Outlet. | The Air Passed through the Room. | Gases Passed Out through the Flue. | The Air Passed through the Room (*Efficiency*). | Gases Passed Out through the Flue. | The Walls, &c., of the Building. | | | | | | | | |
| Cannon Co.'s "Iris" | 36·875 | 19,912 | 2549 | 69·12 | 1·5, rising | 15 | 18 | 700·0 | 830·1 | 3·52 | 4·17 | 92·31 | 1·7 | None | 1·50 | None | 3983 | 2·460 | Dying. | 0·088 |
| Main's "Chelsea" . | 36·625 | 18,697 | 2831 | 81·76 | 2·0, rising. | 12 | 15 | 622·0 | 770·7 | 3·32 | 4·12 | 92·56 | 1·5 | ,, | 1·50 | ,, | 3971 | 2·885 | Fairly healthy. | 0·104 |
| Cannon Co.'s "Victory" (Large) . . | 66·25 | 35,775 | 3072 | 46·37 | 2·5, rising. | 23 | 39 | 1293·6 | 2144·9 | 3·61 | 6·00 | 90·39 | 1·7 | ,, | 1·60 | ,, | 3938 | 2·880 | Nearly dead. | 0·104 |
| Richmond's "Royal Sovereign" . . . | 38·50 | 20,790 | 3175 | 82·47 | 1·5, rising. | 11 | 29 | 639·4 | 1671·0 | 3·07 | 8·04 | 88·89 | 1·2 | ,, | 2·00 | ,, | 4014 | 3·500 | Dying | 0·126 |
| Fletcher's "India" . | 38·75 | 20,925 | 2787 | 71·92 | 0·5, steady. | 10 | 24 | 510·2 | 1211·0 | 2·44 | 5·79 | 91·77 | 0·5 | ,, | 1·30 | ,, | 4045 | 3·870 | ,, | 0·139 |
| Davis's "Beaufort". | 29·75 | 16,065 | 1050 | 35·30 | 1·0, rising. | 12 | 1 | 230·7 | 18·6 | 1·43 | 0 11 | 98·46 | 2·1 | ,, | 1·37 | ,, | 3874 | 2·480 | Fairly healthy. | 0·075 |
| ,, "Albany" . | 35·625 | 19,237 | 1758 | 49·34 | 1·5, rising. | 11 | 14 | 354·0 | 441·4 | 1·84 | 2·30 | 95·86 | 3·2 | ,, | 1·28 | ,, | 3889 | 3·240 | ,, | 0·116 |
| Richmond's "Ilford" | 23·125 | 12,487 | 1479 | 63·95 | 2·0, rising. | 6·5 | 7·5 | 176·0 | 200·4 | 1·41 | 1·60 | 96·99 | 1·7 | ,, | 1·50 | ,, | 3945 | 3·560 | Withering. | 0·128 |

* Such as Sulphur dioxide, unburnt gas, acetylene, &c.

fuel burnt per hour approaches that obtained in coal-fires—being in the majority of cases only about one-third. Of this calorific value a higher percentage is utilized in warming the air of the room in the best coal-fires than in the gas-fires, when once a steady temperature has been attained—the ratio being roughly 3 : 1 in favour of the coal-fires. The percentage which is lost in the flue gases is, however, greater in the best coal than in the best gas fires. When the initial raising of the temperature of the rooms had been accomplished, and the fires had produced a fairly steady rise, the cost per hour for each degree of rise in temperature was about four times as great with the gas as with the coal fires. This does not necessarily mean that gas is always more costly than coal. Other factors must be considered, such as the rate at which the room is warmed. It was found that while the gas-fires usually produced a fairly steady temperature in the rooms in from one to two hours, the coal-fires took much longer. This is in favour of gas-fires. Another point in their favour is that they can be easily regulated and the heat of the room controlled in a way which is not possible with coal-fires.

Taking into consideration the amount of coal which must be burnt before a comfortable and steady warmth is produced, and also the quantity which must be burnt after the fire is no longer required, the examiners think that, even from the point of view of economy, the gas would run the coal very closely for domestic uses, where it is seldom necessary to have a fire constantly burning for long periods. It is the lighting and letting out which make the coal-fire wasteful; whereas a gas-fire can be lighted and turned out as required without unnecessary waste of fuel. They are also of the opinion that a properly constructed gas-fire has the advantage of a coal-fire from a hygienic point of view, owing to the more equable temperature and the absence of dust and smoke. The flueless condensing gas-fires, while very economical of gas, pour into the room a large quantity of carbon dioxide gas. With plenty of ventilation, they would be very suitable for warming rooms or passages where no flue existed to which an ordinary gas-fire might be connected. These stoves make the most economical use of the gas burnt; but this is due chiefly to the absence of a flue, and the consequent losses through it. When, therefore, such stoves are provided with sufficient ventilation to keep the air pure, the heat is carried away in the air currents; and in such circumstances they would probably not be more economical than the ordinary stove provided with a flue. There is also the danger that, if anything goes wrong with the flame, and the combustion becomes imperfect, the poisonous products will be poured into the room instead of passing up the flue as in the case of flue-stoves.

No carbon monoxide was detected in the hot air and gases coming from these stoves except in one case, and in this instance the makers said the stove was faulty, and by mistake had been sent to the tests instead of to their own testing-room. It shows, however, the danger of anything going wrong with such stoves; and in this instance the carbon monoxide was easily detected in the air of the room, which also had a high proportion of carbon dioxide. All the condensing stoves showed a high percentage of this gas in the products of combustion from the top of the stove—reaching as high as 9 per cent. in one case; and this, of course, passes into the room. Its presence in high proportion, as pointed out before, increases the danger from other poisonous gases, should they be present. The most likely gas of a poisonous nature which may be present is carbon monoxide; and this is not found under normal conditions in the products of combustion of coal gas, but may be an intermediate product, as was shown by "The Lancet" Special Sanitary Analytical Commission on Smoke Prevention and Perfect Combustion in 1893. The flue gases were analyzed in several cases during the present tests; but in no instance was carbon monoxide detected in the flue.

One of the most important points which came out in these tests was the very great ventilating effect produced by providing an independent entrance for air to the flue besides that through the stove. The examiners think, therefore, that all gas-stoves should have such an opening provided either in the stove casing itself or in the plate which usually closes the grate recess. This opening should be provided with an arrangement for regulating its size, and thus the quantity of air carried away. The area of such an opening, or the combined areas of all, should there be more than one, should not be less than about 20 square inches when full open. This arrangement will, it is believed, help to remove the popular impression that gas-fires vitiate the air of rooms in which they are burning. Only one stove out of the 25 tested had such ventilators specially provided in its construction.

A fuel which can be easily raised to a bright red heat is required in gas-stoves; and the examiners think that, though the clay fuel as used at present is very effective, there is still room for improvement. A great many of the fires did not heat their fuel to a bright red; only the part near the flames being properly heated. Improvement in this direction should take the form of fuel with a larger exposed surface and a greater network of interstices. It should at the same time be composed of a material which will bear a bright-red heat without injury.

There is a tendency in many gas-stoves when first lighted to produce a smell in the room. This is due to the slow establishment of a proper draught, which has been shown in the tests to go on growing for some time. This probably could be, to a great extent, avoided by attention to certain principles, as follows: The flue should, in the first place, be of sufficient size, preferably not less than 4 inches in diameter, as the losses through it are not so great as is generally supposed. Where the flue is connected to the stove above the fire, it should not be horizontal, but have a

gradual rise to the main flue, so as to encourage the initiation of an upward draught. This would do away with the "elbow"—a feature of nearly all stoves—which is objectionable. Such sudden bends as this and sudden changes of direction should be avoided, as they impede the draught; and though of little importance when the flue has been heated and the draught properly established, they are of great importance when the flue is cold and the draught feeble. In stoves with heating chambers, a direct connection might be made to the main flue as above indicated; and when the draught has been established, this connection might be closed by a damper, and the hot gases directed around or through the heating chamber. The opening of the stove flue should be at the highest point, otherwise a pocket is formed there in which the flue gases collect; and, should there be any leakage due to faulty joints, they find their way into the room. The bottom of the flue opening should be well above the lower edge of the stove canopy. If this is not so, there is danger of the flue gases filling the pocket under the canopy and flowing out into the room.

In conclusion, the report states that the tests were carried out by the Coal Smoke Abatement Society; the technical work being done by Dr. Owens, Assoc.M.Inst.C.E., under the superintendence of Dr. H. A. Des Vœux. The Society expressed their indebtedness to Sir Henry Tanner for his permission to use the rooms in the new public offices, and for the great interest he displayed in the work. They also testify their appreciation of the courtesy displayed by the officials of the Gaslight and Coke Company, without whose co-operation the tests would have been impossible.

## INDOOR ILLUMINATION.

At a Meeting of the Association of Engineers-in-Charge, held at the St. Bride's Institute, E.C., last Wednesday, Mr. JAMES SWINBURNE, F.R.S., M.Inst.C.E., delivered a lecture on the subject of "Indoor Illuminants." The chair was occupied by Mr. W. T. Hatch, M.Inst.C.E., M.Inst.Mech.E., and there was a large attendance of members. The following notes were prepared by the author in advance; and we give also those parts of the discussion which are of more particular interest to "JOURNAL" readers.

If we study a system of (say) gas production and distribution, we find at one end a most elaborate plant for manufacture, in which each part is carefully suited to the end in view and is calculated to give the results desired with the greatest possible efficiency and economy. But what do consumers do with their gas? They just set light to it and let it burn away, and are quite content if they get a little light, until the account comes in. Then they sometimes grumble. It is just the same with electric light. A modern central station is a marvellous study of economical production. There is no industry in which costs are so carefully examined, or so accurately worked out. But all questions of economy end at the consumer's meter. He uses blackened lamps, which are marked incorrectly to begin with, and he covers every light with useless and dirty shades, and has his lamps in the wrong places. It is not that the supply companies take no interest in the matter after their product has passed the meter. Quite the reverse; they are most solicitous for the welfare of their customers. The gas people, for instance, do their level-best to persuade them to use the best burners, or to employ incandescent mantles and get the best results. It is just the same with electric light; it pays the companies if the consumers use good and economical lamps. They will finally want more light rather than smaller payments; and the total supply will go up.

It is an exceedingly difficult task to educate the consumer. The average man is busy all day; and you cannot expect him to spend his evening puzzling out questions of photometry or luminous efficiency. But among Engineers-in-Charge, it is quite worth the while of the man who has to look after the lighting of a big building to become a specialist to some extent in illumination. Some day we may have Illuminating Engineers, who are not Supply Electricians or Gas Engineers, but concern themselves with the application of electrical power, gas, petroleum, and acetylene to lighting, dealing with each on its merits without partiality. At present the question is left generally to architects, house decorators, and chance; and chance has far the most to say in the matter.

In all cases the important point is that the eye should receive plenty of diffused light from the objects that are to be observed, and as little light as possible from any other surfaces. The last part of this is most frequently overlooked in lighting a building. The eye is something like a photographic camera provided with a portrait lens with a very large circle of illumination. It is, therefore, somewhat difficult to arrange lights so that they do not shine into the eye. The eye is shaded above by the eyebrows, however; and this makes the problem easier to solve. What happens in the case of the eye is that it finds it is getting more light than it likes, so that it automatically closes its iris diaphragm. A much more serious matter is that if a strong light comes into the eye at all, the eye is automatically turned to look at it, so that the image is formed on the most sensitive part of the retina. This produces two results—the iris is automatically closed, and the retina becomes fatigued, or the eye is dazzled; and the sensitiveness is lost until the eye gradually recovers it. It is, therefore, most important that the eye should not be exposed to bright lights. It would be almost impossible to light a public or any other building economically entirely by diffused light, with all the lamps out of sight; but the evil of direct lighting can be very much reduced by arranging lamps so that they are high enough not to shine directly into the eye, except from a good distance, and so that they are small as to candle power, and large in area, and give diffused light. From a physiological point of view, therefore, the sources of light should not be intense, but should be small and numerous, or out of sight.

There is another very important question, and that is, What colour should the light be? There is a very general idea that the light which suits the eye best is yellow. It seems probable that, as the eye is the result of evolution, it is best suited for daylight, and therefore daylight is best suited for the eye. It seems, therefore, safe to assume that the yellow of most artificial lights is not a good colour, and that artificial light should be as near sunlight (as it reaches the earth) as possible. This view is supported by the experience of users of the mercury arc. This gives a greenish light, which is very actinic; and it was generally supposed that it would be most unpleasant for the eyes. It is found, however, that though it makes things look very ugly, as far as colour goes, it is very restful to the eye, and is specially useful in drawing offices and suchlike places. Another reason why we should try to make artificial light approach daylight as nearly as possible is that it is necessary if we want to distinguish colours properly. For some business purposes it is quite necessary to be able to judge colours and to match them. There is only one in which yellow light is an advantage; and that is for drawing-rooms and ball-rooms and public places where ladies are in elaborate dresses, and are therefore specially anxious to look as well as possible.

We may divide the illumination of buildings into two classes, general and special. Lighting desks and tables for reading or writing is the commonest case of special lighting. In both cases what is required is plenty of light on the paper; the source being in such a position as to be in itself invisible. This is easily arranged by having the lamp rather behind the reader, and on the left side in addition in writing, so that the shadow of the pen will not give trouble. A small light close to one is much pleasanter for writing than a number of lamps at some distance, as they make a pen work in the centre of a number of radial shadows, which is very annoying. Writing is generally confined to fixed positions, so it is not difficult to provide good lighting; but such places as reading-rooms are more difficult. Probably the best plan is to have plenty of light coming downwards from near the ceiling, so that the lamps do not shine into the eye. The lights should not be so few that a dark shadow of one's head is thrown on the book or paper. Such special cases as shops or warehouses in which colours have to be matched, do not need special discussion, as the chief point is to choose sources of light which give something as near daylight as possible. The walls should be pure white. If they are light in colour, they return a good deal of the light that falls on them; but if they are coloured they return coloured light, so that a room with yellow walls will have yellow light, though the source of light may be the sun itself.

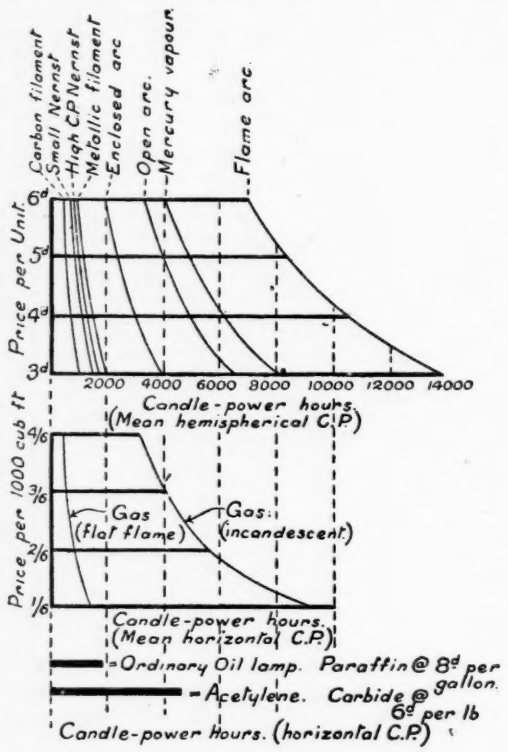
In the case of general lighting—for instance, of a dining-room, a ball-room, or a town hall—I would again suggest that the really important point is to arrange the lamps so that they do not trouble the eye and cause the iris to close automatically or tire the retina. We are all far too intent on getting the greatest candle power at a given expense. It is no good having 10,000-candle power in a large room, if you can really see better with 1000-candle power properly arranged. Another point in this connection we nearly always overlook, or we underrate its importance—and that is, the colour of walls and hangings. Suppose a large room has a number of small lamps distributed in it, and suppose the walls are quite black, anything in the room is lighted by the lamps directly, and gets no light from the walls. Now suppose the walls are repapered so as to have a surface which only absorbs half the light that falls upon them, this helps the lamps to such an extent that they can give twice the illumination.

It is very difficult to make any useful comparison of the costs of various illuminants, as each has special advantages and drawbacks. In the old days we used to compare the electric lamp giving about $\frac{1}{3}$ candle per watt with a flat-flame burner giving 2 candles per cubic foot; and it was usual to assume that the gas was left on longer through carelessness and difficulties of lighting. Now it is more usual to compare the electric lamp, giving about $\frac{1}{4}$ candle per watt and lasting a short time, with incandescent mantles giving 20 candles per cubic foot of gas and lasting for ever. Now the fact is, that the average electric incandescent lamp in use in this country was badly graded to start with, and has been run until it is black. Its bulb is also dirty; and it is inside a dirty shade which cuts off a large percentage of any light that has been fortunate enough to get so far. The incandescent mantle, on the other hand, may have been capable of giving 20 candles per cubic foot to begin with, and it has gone down considerably; and it is on a burner with the gas pressure wrong, and part of the mantle has tumbled off, and the jets and burner are partially choked. It is enclosed in a chimney which has an opaque white deposit on it, and a black deposit of dirt outside; and that is again in an outer glass which is either opalescent or coloured, and is also dirty. The whole arrangement probably casts a shade just where

the light is wanted. It is not easy to make any comparison between such sources of light; but allowing for all inaccuracy, the incandescent mantle must come out far ahead of the carbon incandescent lamp. But there are many other questions. One of the most important is the size of the lamp. The electric lamp most used is 8 candles new; and it is no use comparing this with a 60-candle gas-lamp.

The cost per candle power in payment to the supply company is not difficult to get out. The accompanying figure, prepared by Mr. Claypoole, gives a great deal of information in a graphic form. It tells you how many candle-power-hours you can get for 1s. from various illuminants. Thus, if electrical energy is at 5d. per unit, a carbon filament will give you, roughly, 500 candle-power-hours—say, 10 candles for 50 hours for 1s. paid to the supply company. If the electrical energy is 3d. per unit, as at the bottom of the diagram, one shilling's worth of energy will give you 2000 candle-hours with a metallic filament lamp—say, 20 candles for 100 hours; or with a mercury vapour lamp, you can get 8000 candle-hours, or (say) 100 candles for 80 hours. A flame arc at 4d. per unit, again, gives 10,500 candle-hours for 1s., or (say) 1050 candles for ten hours.

Turning to the gas diagram below, you find that if gas is at (say) 1s. 6d., a flat-flame burner gives about 1400 candles for 1s., and so on. The incandescent burner, however, gives over 3000 candle-hours for 1s. at 4s. 6d.—that is to say, on the top line.




**Candle-Power-Hours Obtained for One Shilling from Different Illuminants.**

This might be, for example, 60 candles for 50 hours. At 3s. 6d., it gives about 4000 and so on. Oil-lamps have been taken for one price of oil only (8d. per gallon), and acetylene with carbide at 6d. per lb. These figures take no account of the costs of renewals of electric lamps or mantles, or of trimming and providing globes for arc lamps. They, therefore, do not really give a comparison of the costs. Moreover, the lamps and mantles are taken as new. All the same, the figures are very instructive. It will be seen that oil-lamps are much cheaper than either ordinary electric carbon lamps or gas with ordinary burners, and acetylene is astonishingly cheap. Each illuminant nas, however, its own special advantages and drawbacks.

By far the most important illuminants from this Society's point of view are gas and the electric light. So far as cost of gas and electrical energy go, it is not difficult to compare the rivals; but it is much more difficult to compare the cost per candle-hour, including lamps and mantles and incidental expenses. We need hardly consider the ordinary flat-flame burner now, though it is still very generally used. In the same way we might almost put the carbon lamp on one side, because it appears to be doomed, as the metal wire lamps seem bound to push it out of existence as soon as they can be made in large enough quantities, and, what is more important, as soon as the public get into the habit of asking for them. The metal lamps are far more efficient than the carbon; but they have some special drawbacks of their own. Some do not work well on alternating circuits. This is a difficulty that exists in some lamps only, and will most likely soon be overcome. The other, and serious, difficulty is that it is apparently impossible to make quite small lamps for reasonably high pressures. One of the great advantages the carbon lamp had over the mantle was that it could be made very much smaller without loss of efficiency. If you only wanted three candles to light a passage, for instance, it was no use having a 50-candle gas-lamp unless the 50 candles cost as little as the 3-candle electric lamp. Again, in lighting a large room a number of small lamps is better than a few large burners. But in cases where the question of small lamps does not come up, the mantle seems to be much more economical.

It is thus impossible to get any sort of clear idea as to the relative prices of lighting by electricity or gas. Broadly, we may say that gas lighting with mantles is very much cheaper than any form of indoor electric light, except the mercury-lamp. There are other questions, however. One is that of health. Gas uses up the air. This is a matter of great importance, especially in towns. It is not generally known that rooms are ventilated a good deal through the walls. In towns, the living rooms are more closely occupied, and have less outside wall; it is thus more important that the gas should not use up the air. Incandescent gas, of course, uses much less air in proportion to the light than the old flat-flame burner; but even thus, compared with human beings, the air used is a very serious consideration. As to sulphur, I would suggest that gas has been rather maligned. Sulphur dioxide is exceedingly bad for plants; but it is not necessarily so for animals. No doubt it is deleterious, however; but the probability is that each of us breathes a hundred times as much sulphur dioxide from burnt coal as from gas. Gas is maligned perhaps in another direction—the destruction of book bindings. According to "Leather for Libraries," the products of combustion of gas are not responsible for the destruction of leather bindings. At the same time it is difficult to believe a high temperature alone is not enough to injure books. Anyone who has not gone up steps to the top shelves of a gas-lighted library will be astonished at the high temperature to be found there.

There is another consideration as well as that of light, and that is the convenience of gas and electric supply for other purposes, such as power and heating. For distribution of power in small quantities, of course, the electric motor is supreme; though for what would be large powers in domestic use the gas-engine comes in. In heating, neither would appear to have a chance against coal; but gas has many very great advantages. Just as gas heating can replace fires, electric heating can in some cases replace gas. One cannot help feeling that this is largely the fault of the gas engineer. It seems to have been the idea of the original makers of gas-fires that a bunsen burner got more heat out of the gas than the ordinary flame; and the result is that most heating and cooking stoves have bunsen burners. Though a bunsen may burn perfectly alone, if you put a kettle on it, it seems at once to have the combustion checked, and to give off bad gases—probably carbon monoxide. Now very nearly all the boiling-burners on cooking-stoves are of the bunsen type. Nine-tenths of the heating stoves for living rooms have bunsen burners whose flames are choked with asbestos or iron radiators. The fumes then escape partly into the room even when there is no down-draught in the chimney. Anyone who values his health should never use a bunsen flame gas-stove without making sure that no bunsen fumes come into the room. The gas-stove might learn something from the electric stove. The object of a stove is not to heat the air that is in contact with it, but to radiate the heat. The electric stove radiates most of its heat, and this gives it just where it is wanted, and is, therefore, useful in spite of its ridiculously low efficiency. The gas-stove, on the other hand, is not made with any intelligent comprehension of radiation.

Gas and electric light are by no means the only kinds of illuminant that concern us. In many cases acetylene is specially suitable. This does not seem to have been as successful as it deserves. Acetylene is cheap, taken in candle-hours per shillings-worth of carbide; but, of course, the generator needs attention, and the foul lime has to be got rid of somehow. In places where there is neither electric nor gas supply, there is a great opening for acetylene.

Carburetted air gas is another claimant for favour. In the "National Air Gas" system the air takes up about ½ per cent. of hydrocarbon, and it is used for the incandescent mantle. The Company claim that, with cheap petroleum (at 8d. a gallon), their system gives 1000 candle-hours for ½d., or 24,000 candle-hours for 1s. This would be right off the diagram, and would be less than half the price of the light of the flame arc. I have no knowledge of this system myself. I have merely taken these figures as presented to me; but they are good enough to warrant our giving the system very careful attention.

### *Discussion.*

The PRESIDENT asked the members to thank Mr. Swinburne heartily for his paper. He said that most of them had to deal at least with one of the illuminants that had been mentioned. Some of them could speak to making great savings by the exercise of care at the "burner-end." It was very necessary to learn how to use gas or electricity economically. He had just fitted up a little place in the country, and he was anxious to get some incandescent mantles for use with oil. On inquiry, however, he found that this system was not recommended; and so it seemed that they had not got so far with the oil industry as with gas and electricity. They some of them in their business day by day

looked out to see if they could make big economies; but the lecturer had indicated how they could make big savings out of little economies.

The vote of thanks having been carried with applause,

Mr. W. H. Y. Webber, referring to the diagram exhibited, remarked that the words "Gas, Incandescent" must mean the ordinary incandescent burner. The author had left out the whole gamut of high-pressure intensified gas lighting. He thought that if this gap had been filled in, they would have had the toe at the bottom carried out about twice as far as it was, inasmuch as with this system it was easily possible to get 40 candles to the foot. Then the author had alluded to the defective ventilation of rooms, and made a great fuss about the matter. He said that gas used up the air. Well, so did human beings; and they could have all the air they wanted, if things were only reasonably arranged. Surely, there was such a thing as opening a window! In this connection, he might refer Mr. Swinburne to a very interesting series of experiments carried out by Dr. Samuel Rideal and Mr. Otto Hehner, which showed that this idea of using up air by gas was altogether beside the mark, and that half-an-inch of open window would more than correct this terrible consumption of air. Then the author went on to say, when referring to the injury to books: "Anyone who has not gone up steps to the top shelves of a gas-lighted library, will be astonished at the high temperature to be found there." He was afraid from this that Mr. Swinburne had not gone up the steps in a library for a good many years. The remark would have been perfectly just twenty years ago; but in the case of a room lighted—and brilliantly lighted—by means of incandescent gas, Mr. Swinburne would need a very sensitive thermometer to distinguish any difference in temperature between 4 feet from the floor and anywhere that he could get near the ceiling. This was the difference that incandescent gas lighting had made. Later on the author referred to the bunsen burner and the gas-stove. Of course, there were bad and imperfect gas-fires, and bad and imperfect burners; but he was afraid Mr. Swinburne was a little behind the times. At the present time gas-fires were being constructed on the principle enunciated by the late Frederick Siemens. At last some of the makers had found that when he said one must not allow the gas-flame to touch anything, Frederick Siemens was right. This was being done now; and he should say that the duty of gas-fires had been doubled during the last twelve months. As to acetylene, he did not know whether the author had lived in a house lighted by this means; but he (the speaker) had heard of a case some days previously. It was a small country house; and the installation cost £200. The light was turned on for the first time on the occasion of a ball; and it was turned out shortly after. Acetylene in a closed house was not a thing very many people would like to take the risk of.

Mr. F. S. Thorn, referring to the failure of acetylene, said he would like to ask Mr. Webber how, if what he had mentioned was the rule and not the exception, he could explain away the fact that during the last eleven years acetylene lighting had been growing continually in this country, and in America and on the Continent in an even larger degree. Whoever put up the acetylene installation spoken of, if they left it until the night of the ball to light the gas had made a great mistake. The diagram accompanying the paper showed very clearly the comparative candle powers obtained from different lights at various costs; but the author had made an error in the price he had put down for carbide—6d. per pound. The price that consumers paid for carbide nowadays was certainly not more than one-third of this amount—that was, 2d. per pound, including carriage. He knew people who lit their houses by means of carbide obtained in the original drums at 15s. per cwt. As acetylene was practically the same as sunlight, he submitted that it was the best light of all for people to work by. Using acetylene, it was possible to get such a splendid light with the naked flame that, even supposing a perfect acetylene incandescent burner and mantle were on the market, it would not be worth while to use them. Up till now, acetylene incandescent burners had not been a success, so far as he knew, in any part of the world. With regard to the author's observations about the effect of heat upon leather bindings, it seemed to him (the speaker) it was very often forgotten that it was not only coal gas or acetylene, or gas of any kind, that gave forth heat, but also that electric light gave out perceptible heat in a room. He had been up the steps of a library so lighted, and found a very considerable increase in the temperature.

Mr. F. Broadbent, after remarking that the discussion seemed to have got somewhat away from the original intention of the author, said there was no doubt the public wanted considerable education as to the best and most economical way of using light. There was a great deal in the disposition of the lights and the shading of them. He quite agreed that if one put a cold article on a bunsen burner a lot of unburnt gas resulted; but this was not at all the same thing as incandescent asbestos cobbles, because they were hot, not cold. There was a great amount of radiation from the asbestos cobbles, quite apart from the convected heat warming up the air. Then he was not sure about radiated heat being the best, because if they used a radiator in a room in wintry weather, they were burnt on one side and frozen on the other. He had lately visited a place which should have been lighted by intensified gas; but the motor had gone wrong, and so it was not lighted at all. As to acetylene, he had stayed where it was burnt all night without experiencing any ill-effects.

Mr. F. W. Goodenough said the portion of the paper dealing with heating was very interesting; but he thought Mr. Swinburne must have had a very unfortunate experience in regard to gas-fires, or had got hold of some very antiquated specimens. As far back as 1893—thirteen years ago—the "Lancet" appointed a Special Commission; and after making a most exhaustive series of tests (one of the points being that the air of the room was aspirated through blood), they were not able to discover that the use of gas for fuel had in any way vitiated the air of the room. Mr. Swinburne had said that one of the objections to gas-fires, compared with electric radiators, was that the gas-fire caused a furious draught; but if there was one point which medical men—who were as a body favourable to gas-fires—sometimes urged against the gas-fire, it was that it did not create a sufficiently furious draught. It was distinctly in his (the speaker's opinion) a point against the use of electric radiators for heating that they afforded no means of ventilation. He had seen some instructions sent out with electric radiators to the effect that the chimney of the room should be closed up with sheet iron. His Company (the Gaslight and Coke Company) had some 80,000 gas-fires out in their district; and their experience was not coincident with that of Mr. Swinburne. The modern gas-fire to which Mr. Webber had referred was being made with the asbestos so arranged that the flame came straight up through what was practically a tube of asbestos. The old iron fret fire was certainly the most efficient in radiation that they could have. He had one in a considerable sized room; and one was almost bound to overheat the room with it, although it only consumed about 40 cubic feet per hour. A modern fire should not burn more than 20 to 25 cubic feet per hour to heat a sitting-room. Mr. Broadbent had referred to a motor that went wrong in connection with a high-pressure gas installation. His (the speaker's) advice was, "Do not use a motor, but a gas-engine; and then it will not go wrong." As a matter of fact, most systems of high-pressure lighting worth having did not leave a place in darkness in the event of anything going wrong. The lights continued to burn, though, of course, not so brightly as when the pressure was on. At Woolwich Arsenal, they would see the lights burning at low pressure; and then the high pressure was put on to them, so that it did not mean absolute darkness if the pressure failed. Of course, in a large installation, such as Victoria Station, which his Company had fitted up, a duplicate plant was put down, so that there could be no failure. The cost of running this system was small—only about 2½ per cent. on the total cost of the gas consumed; and for this they obtained double the efficiency. Mr. Swinburne referred to 60-candle gas-lamps as being the smallest available unit; but he had evidently overlooked the fact that the small inverted burner, with 1 cubic foot of gas, gave from 16 to 20 candle power, and therefore furnished the small unit of light that was desirable in some cases.

Mr. Broadbent remarked that when he said "motor," he meant the compressing engine—not an electric motor.

Mr. Spratley thought that, in connection with lighting, very often not sufficient note was taken of the surroundings—for instance, the papering of the room. They expected to get the same amount of light with a non-reflective paper as from paper which was of a reflective nature. He would be glad to have some particulars as to the cost of renewals in the case of the metallic filament lamps.

Mr. Leon Gaster said that, having suggested the formation in this country of an Illuminating Engineering Society, he was glad to see Mr. Swinburne's encouraging references to this question. The Engineer-in-Charge had already so much to do that it was almost impossible for him to be fully aware of the progress made in illuminating matters. The Illuminating Engineer had quite a *locus standi*; and he would be a very useful man as a *bonâ fide* assistant to the would-be consumer, in pointing out the proper places for lights, the right type of lamps to use, and above all the best shades and reflectors to apply.

Mr. Hollamby drew attention to another light suitable for outside purposes and workshops or large buildings. This was the Kitson oil-lamp. For outside lighting it was difficult to get anything cheaper; but he did not think it was very suitable for indoor purposes. In his opinion, the burners in many gas-stoves were fitted too near the object to be heated.

Mr. W. H. Booth said he thought it was begging the question to bring in the matter of ventilation. In any room which was ventilated sufficiently, it should make very little difference whether the lighting was by electricity or gas. High-pressure gas lighting was so cheap that they could afford to waste half of it, and still save over the electric light. In fitting up a building, the lights themselves should be out of sight; and then the ventilation should be carried out in some such way as they had seen in operation at the new Central Criminal Court.

Mr. A. E. Penn agreed that, if proper ventilation was introduced, it did not matter which light was used; but it was important if they could not get the architect to adequately consider the question of ventilation. As showing that the burning of gas had some detrimental effect on the atmosphere of a room, he quoted figures by the late Dr. Meymott Tidy.

Mr. Swinburne, in replying to the discussion, said Mr. Webber had called his attention to the fact that he had ignored high-pressure gas lighting. Certainly this had escaped his attention. He had stayed in acetylene-lighted houses; and they were quite comfortable. He did not say a gas-stove caused any fumes so

long as the draught of the chimney was right. When the ordinary asbestos balls as put in a gas-fire were thoroughly hot, there was probably a temperature at which carbonic oxide was not formed; but a large portion were in the bunsen flame, and would still be at a temperature at which carbonic oxide would be given off. As long as this went up the chimney, it did not matter. But he found in some cases that with a gas-stove there was an intermittent draught, and if this happened, and the chimney cooled, it was impossible to avoid getting carbonic oxide. The inverted lamp might be liable to the same danger of bad gases, because the ring of the inverted gas-lamp was apt to be not quite hot enough to prevent the irruption of such gases. He was not quite sure of this; but he suggested it. He thought the iron fret could not be the most efficient form of stove, as Mr. Goodenough had said.

## SCOTTISH JUNIOR GAS ASSOCIATION.

### Eastern District.

A Quarterly Meeting of the Members of the Eastern District Section of the Association was held in the Heriot-Watt College, Edinburgh, last Saturday afternoon, at which there was a better attendance than usual. Mr. W. Brown, of Lasswade, the President, occupied the chair, and expressed his gratification at seeing so many members present. He remarked that the session was promising to be as successful as, if not more so than, its predecessor.

### SOME EXPERIENCES IN DEALING WITH CONSUMERS AND THEIR COMPLAINTS.

Mr. A. Bishop (Newtongrange) read a paper on the above subject. In the course of it he said he had 605 consumers, of whom 558 were employed as miners, and resided in properties owned by the Lothian Coal Company, Limited, who also owned the gas-works. The service-pipes, meters, and all internal fittings, were repaired and kept in order by the Company, free of charge, with the exception of a sum for meter-rent. The remainder of the consumers he might call private consumers, as they did not reside on the Company's properties. In each case the service-pipes were laid right up to the meters, and were kept in order gratis. In some cases the meters belonged to the consumers; but the majority were put in by the Company, and meter-rent was charged. In every case where repairs or alterations to fittings were executed by the Company, a charge was made for time and material used. All meters were surveyed every fortnight. The reason for doing this was that the miners were paid fortnightly, and they preferred that all charges for gas should be deducted from their wages. The private consumers also preferred to pay their gas bills every two weeks (and in this case he surveyed the meter and collected at the same time), with the exception of ten, who had their accounts rendered quarterly or half yearly. The survey was finished a week before the pay-day. The index books were then taken to the colliery office, where the records, the quantity of gas consumed, and the amount due by each consumer were entered in meter ledgers kept there. The amounts due were taken from the ledger and entered on the pay-sheets. In order that any error might be put right, each consumer was told, when the meters were surveyed, the quantity of gas he had used, so that when he received his pay-sheet he could check the amount that was being deducted. The general complaints were in regard to escapes and bad gas. Escapes were sometimes found in lead service-pipes, and were generally caused by rats gnawing through the pipes. The service-pipes were taken through the brick walls of the houses, which had an open space 3 inches wide in the centre of them. The holes on either side of this space had not been built up, and the rats, when they found they could not get through, attacked the lead pipe in order to make a passage. He had the holes filled up, after which, in three cases, he had second complaints, the cause of which was that the rats had found their way into the space in the centre of the wall, and had gnawed the pipe through there. As he did not wish to have more complaints, he fitted iron pipes through the walls. An escape was sometimes caused by a nail having been driven through a gas-pipe. In repairing this, it was necessary to cut away a good bit of paper and plaster, to which some consumers objected, until such time as the paper had to be renewed; and meantime they stopped using gas. In order to overcome this difficulty, he bent the point of a soldering bolt, so as to get at the back of the pipe. He then cut the paper 1 inch square on three sides, and pinned it back to the wall, in order to prevent its being burnt by the hot soldering bolt. The plaster was then cut, and instead of taking out a portion of the pipe, it was soldered back and front. In no case had there been any objection made to this being done.

Referring to the testing of fittings by meter, Mr. Bishop said he found that, in the case of small escapes, a great deal of time was spent, and a good number of candles were burnt, before anything could be noticed; and sometimes it was necessary to suck fittings to find where the leak was. In thinking the matter over, the idea occurred to him, more than two years ago, that he could test fittings with the ordinary pressure-gauge which he had for taking pressures in the district. He therefore put up one of Milne's 3-inch gauges for the purpose. The stopcock on the meter having been shut, and the gauge fitted to the bracket by an adapter and rubber tubing, the pressure could be raised, by blowing, till the gauge showed 3 inches. The tap on the blow-tube then being shut, if the pressure were maintained, the fittings were gas-tight; but if there were the slightest leakage, the pressure would fall. The advantages of this method were that the apparatus was a fittings tester and pressure-gauge combined; that it could be used anywhere, and could be carried about in the pocket.

Complaints of bad gas were frequently due, the author said, to water deposited in the service-pipes. Where large fires were kept on in kitchens, and a wet gas-meter was fixed close by, the water in the meter was evaporated, and passed to other parts of the house where the temperature was lower, and there it deposited. In the case of one consumer this had been going on for years before he drew attention to it. Having a dairy, the consumer had a washing-house with boiler at the side of his dwelling-house. There was a wet meter in the washing-house. He put the outlet-pipe from the meter through the wall about 6 inches above the level of the outlet of the meter, and made a series of S-shaped bends on the pipe, returned it through the wall at a higher level, and jointed it on to the pipe going to the brackets. The bends on the outside of the wall, being in colder air, acted as a condenser, and returned the water to the meter. This was done more than two years ago, and the consumer had never had occasion to complain since. The best way of convincing the public of the value of the service gas managers were rendering was to get to the bottom of every complaint. No matter however trifling, each case should be treated by itself. Consideration shown to every complaint, with persistent, patient hammering at the idea that the principles underlying the selling of gas were just the same as those governing any other commodity, would make headway with the most prejudiced community.

*Discussion.*

Mr. J. R. Moyes (Edinburgh), the Hon. Secretary, questioned whether the practice of deducting from miners' wages for gas consumed by them was not coming very near an infringement of the Truck Acts.

The President said that, having had experience among miners, he knew that at most collieries there were deductions from wages for various purposes—house-rent, doctor, sharpening tools, gas, and the like.

Mr. H. Gourlay (East Wemyss) remarked that it was sometimes very hard to convince consumers that gas companies were not defrauding them, when their bills were heavy. He thought that meter inspectors should try to humour consumers.

The President considered that those of them who had had experience with consumers would admit that the author of the paper had treated his subject fairly well. It was not every gas manager who was situated as Mr. Bishop was, in surveying every fortnight; most did it only three times in the year. In having the control of the internal fittings, Mr. Bishop had the means in his own hand of rectifying any complaints as to bad gas. In his (the President's) case, he did nothing but lay the mains. Where there was a long service-pipe, they might do some portion of it; but they did not, as a rule, supply anything except the mains. In a small place, complaints were numerous; and if gas managers suggested anything, the landlord would do nothing; and so they had either to lose the consumer or do the work themselves. He preferred the latter. Mr. Bishop was in the happy position of not making any bad debts. Sometimes complaints were trifling. Mr. Bishop's idea as to the finding of leaks was a very good one. For all gas-fitters and inspectors, it would be a useful thing to carry about with them one of the appliances mentioned. He proposed a hearty vote of thanks to Mr. Bishop for his paper.

This was accorded, and Mr. Bishop returned thanks.

The following questions were on the *agenda*:

1.—*Whether strong or weak liquor at the washer has the greater affinity for $CO_2$, and at what strength is it most efficient?*

Mr. D. Bisset (Edinburgh) said he considered the question not so simple as it looked. It was very difficult to give a definite answer to it, as so much depended upon local circumstances and conditions. He did not think there was any special strength of ammoniacal liquor that took out the carbon dioxide more efficiently than other strengths. They had the subject dealt with recently in the address of Mr. James M'Leod, the President of the Western District (see *ante*, p. 178). He gave a series of tests of liquors, and a table showing the degrees Twaddel and the percentages of carbonic acid, sulphuretted hydrogen, and cyanogen in the different chambers of a Walker scrubber, and also of the carbon dioxide present. He had just read the address again, and found that with liquor testing from 0·6° to 2·1° Twaddel the increase of carbon dioxide per degree Twaddel was 0·72; from 2·1° to 5°, it was 0·53; from 5° to 8·6°, 0·59; from 8·6° to 11·5, 0·7; and from 11·5° to 13·5°, 0·5. It would appear from these figures that the increase in carbonic oxide for every degree Twaddel did not vary to any considerable extent. The weak liquor seemed to be about as efficient as the stronger. He had found this to be his own experience in making tests. In the scrubbing of crude coal gas for the extraction of these impurities, there were four conditions necessary. The first was that the gases should enter the washer-house pretty cool, and freed from a good

deal of their tarry matter, because if this came in along with the gas it made the machine dirty. The second condition was that the liquor used for scrubbing should also be cool; the third, they should have ample scrubbing power; and the fourth, that the scrubber should be such that, no matter whether it was a mechanical one or some other type, the gas should have a long travel, and come intimately in contact with the liquor. If they had these four conditions, he thought they would get very good results in the way of the extraction of impurities. He had often thought that the time would come when the scrubbing of coal gas would be done in closed vessels, and with liquid substances. No person employed in large works could help looking at the amount of capital expenditure involved in putting down plant for dealing with these gases, and the labour and expense of handling so much dry material. If purification could be done in one or two sets of vessels, working with liquid chemicals, such as caustic soda, extracting impurities, and then re-causticizing the liquors and using them again and again, it could be done a great deal cheaper than by the dry method. It would be very much simpler, and the capital would be considerably less.

Mr. J. Dickson (Kelty) said he did not know that they who were in small works had the same chance as managers in large works of ascertaining exactly what strength of liquor was most efficient for scrubbing. This was a question in regard to which they were indebted to Mr. Bisset, or some of the Glasgow or Edinburgh chemists, to keep them right. Where he was, there was a washer working quite apart from the scrubber—a brush scrubber, with the means of running the strong liquor from it into the washer. At present he was running liquor from the scrubber into the washer, and treating the gas first with 10° Twaddel (20 oz.) liquor, and gradually decreasing till, at the top, it was treated with clean water; running at from 10 to 12 gallons per ton of coal, or about 60 gallons per day. Working with Fife coal, which contained a large proportion of carbonic acid, he thought this treatment with liquor had a very beneficial effect upon the purifiers. He purified with lime, and really the amount of carbonic acid in Fife coal deadened the purifiers so that they were not nearly so efficient as they should be for the removal of sulphuretted hydrogen. But he thought they would be indebted to any of their Edinburgh brethren who had the means if they would analyze the liquor, and make thorough tests, so that they might all have something to go upon.

Mr. Bisset said Mr. M'Leod had put on record a series of tests, and anyone could calculate from them. Unless both the gas and the liquor were fairly cool, they would remove very little. If they were warm, instead of the liquor taking up impurities from the gas, it might be that it would give some to it. He should not be prepared to say just what the temperature should be; but he would suggest the atmospheric temperature, or thereabouts.

2.—*What is the minimum depth at which mains should be laid in causewayed streets and macadamized roads?*

Mr. J. Mitchell (Granton) said that, in main laying in causewayed streets or macadamized roads, he saw that they had a cover of 2 feet. This was a very fair depth, either for working or for taking off service connections.

Mr. R. B. Carson (Leith) thought the minimum might be 1 ft. 8 in. The maximum, of course, depended upon what they had to meet with. It was generally recognized that 2 feet was a good depth. The services could be taken off easily at 2 feet of cover, in the case of the main next to the kerb; but if the service had to cross a road, he thought the cover should be 2 ft. 6 in.

Mr. J. Dickson did not think there were any figures at all applicable to main laying. A main which had a proper bottom, with 18 inches of cover, would stand all the heavy traffic that was likely to pass over it, including traction-engines. But where the ground was very much undermined, he would say about 2 ft. 9 in. of cover was necessary. Even with this they might have a main breaking, if the foundation and the bottom were not good.

Mr. Bishop said his experience in the crossing of a road where the road-roller passed was that there should be 2 feet of cover. He had never had a broken pipe laid at this depth.

The President said that at Lasswade the mains had a cover of from 7 to 9 inches only in the main streets; but in the side ones they were down 3 feet. He had never had a fractured main. There was a good sandy bottom.

Mr. H. Gourlay considered that a 2-inch main required to be laid pretty far down; but a 4-inch or a 6-inch main could resist the strain better. He had put down 6-inch Mannesmann tubes, and these he found very useful for resistance, though he had not yet had much experience with them in the matter of tapping for connections.

3.—*Should services be fixed on the top or on the sides of mains?*

Mr. R. B. Carson thought this question was a very simple one. When they had asked as to the depth of mains, he did not think they needed further information, because the services would be governed by that depth. If a main were deep, the service connection would be on the top; if shallow, it might be on the side. The top was preferable, because the gas had a tendency to rise, and there was less friction than with a side connection. If the main were shallow, they made a side hole; but the service might be too shallow if they had to run any distance. If the main were 3 feet from the kerb, and they had 2 feet of cover, he should say make a top connection.

Mr. J. Dickson thought he must bow to Mr. Carson in the matter of experience as to the boring of a main on the top or at the side; but if it was on the top, there must be a knee on the service-pipe, and the gas would have to turn a corner, and it would thus be impeded. He thought a side connection had a tendency to give a better supply of gas than one on the top.

Mr. H. Gourlay thought it was a general rule that services were taken off the side, unless the main were at a depth which made it desirable that it should be taken off the top.

Mr. J. Mitchell said his experience was that it was best to take services off the top of the main, because they had a drier gas there.

Mr. J. W. Lill (Edinburgh) thought the gas got better away from the main if the service were on the top than it did with a side connection.

The President said he always understood that the difference of opinion as to whether service connections should be on the top or on the side of the main was as to the strength of the service and that of the main. He never understood, until that meeting, that the position of the service-pipe had any effect on the flow of the gas. In Mr. O'Connor's class, the point was always made that the service connections should be on the top, and not on the side; but he himself had always had to bore on the side.

This brought the proceedings to a close.

## Gas-Engines for Producing Electric Power.

In the "Journal" for the 6th inst. (p. 392), in the introductory lines of an article on "Gas-Engines for High-Speed Railways," calling attention to two cases recorded in Vol. CLXV. of the Minutes of Proceedings of the Institution of Civil Engineers, it was remarked that the use of gas-engines in the central station of a high-speed inter-urban railway was "something of a novelty." Messrs. J. and O. G. Pierson, of Paris, the agents for France of Messrs. Crossley Bros., Limited, have written to point out that some twelve years ago two Crossley "Otto" gas-engines were erected, through them, in the central station for electrically working the Lausanne tramcars; while in 1898 they negotiated an order for two-engines of 128 B.H.P. for the Poitiers Tramcar Company. They have also sold seven engines, of 165 B.H.P., for the Orleans and Tunis electric tramcars. Since 1899, the electric tramway system at Cassel (near Dunkirk) has also been worked by three gas-engines; the gas used in them being made with one of the firm's pressure producer plants.

## High-Pressure Incandescent Acetylene for Lighthouses.

A description has been published by M. Maurichéau-Beaupré, the Chemist to the Société Commerciale du Carbure de Calcium, of Paris, of the installation of high-pressure incandescent acetylene which has been in operation since the close of 1902 in the lighthouse at Chassiron, on the Island of Oleron, off the west coast of France. The gas is generated in a hand-fed apparatus of special design, which enables the pressure of the acetylene to be set at will at any height between 49 and 79 inches water column. The gas is scrubbed with coke; dried with calcium carbide; and then stored in a pair of holders, each having a capacity of 140 cubic feet. From the holders, it passes through purifiers (charged with the proprietary article known as "heratol") to the incandescent burner, which carries a mantle 55 mm. in diameter at its base. At the normal working pressure of 49 inches, the burner consumes 20 cubic feet per hour—yielding a light of 2100-candle power. The duty of the burner is thus approximately 103-candle power per cubic foot; and the intensity of the light is 325-candle power per square inch. As there is only a limited supply of fresh water in the neighbourhood of the lighthouse, the cream of lime from the generator is run into two settling tanks placed in series. The clear liquor is withdrawn and pumped into an elevated reservoir for use over again; the thick precipitate is thrown into the sea. Originally (it may be added from other sources of information) the Chassiron lighthouse was provided with an ordinary six-wick petroleum burner. In 1895, the plant was replaced by one consuming compressed oil-gas under a mantle. In 1902, the acetylene installation was brought into operation. Each change is stated to have roughly doubled the specific intensity of the light, and also the illuminating power of the concentrated beam, which is now said to be equal to some 275,000-candle power. The light itself is a flashing one.

**Utilization of Waste Power.**—In the course of his address to the Cleveland Institute of Engineers, at Middlesbrough, the President (Mr. G. H. Harrison) referred to the utilization of waste power. He remarked that if ironmasters would only combine and put down electric power plant driven by blast-furnace gas at various points, they could supply electric power for the whole district, including works, at a price far below that at which it could be produced by other means. They could supply the area from Stockton to Eston—works of all kinds where large power was required, besides the electric lighting of the two towns, the electric tram wants, and eventually the electric local trains. The matter was one for serious consideration; and he saw no insurmountable difficulty in the way. If such a scheme was carried out, it would be one of the greatest strides Cleveland had ever made.

# CORRESPONDENCE.

*[We are not responsible for the opinions expressed by Correspondents.]*

## Road Construction and Mending and Tar Paving.

SIR,—Those of your readers who are studying the above interesting subjects will, I am sure, feel grateful to you for publishing in your last number (on p. 453) the extracts from the completed discussion of the two papers read before the Institution of Civil Engineers earlier in the year, of which you gave summaries at the time, and also (on p. 457) the extract from "Engineering Record" as to the dust-prevention experiments in New York. Several passages in these reports deal with parts of the subject which were discussed to some extent at the recent meeting of the Midland Gas Managers Association, and help to emphasize the importance of suitable "tar" being used to secure success.

I should like to use your columns to assure those who need tar or asphalt compound of the most suitable composition for this purpose, that there need be no difficulty in their obtaining the same. Any tar distiller knows and can supply what is exactly the best for the purpose, if the nearest gas-works cannot do so.

It is really no new thing, as one of the speakers at the Institution meeting said; but there are two or three essentials to be observed. The slag or stone of which the macadam is to be made must be dry and warm when mixed; and the special asphalt tar must be of the right composition. There is now no reason why pitch of the proper quality, and tar oils of the right grade, should not be mixed to such a consistency as to be quite successful. But where tar is used for the above purpose, it should be boiled, as readers will notice is clearly stated in your extract from the New York paper. If it is so thick that it will when cold only just flow out of the bung-hole of a cask, when assisted by a vent-hole, it will be quite fluid when sufficiently heated, which should not be to boiling point.

Many of your readers know that I consider there are more reasons than that of merely ridding it of its associated water, why tar sold for this purpose should be properly dealt with when supplied from a works where the chief business is to get as large a bulk of illuminating gas as possible from every ton of coal used.

Road surfaces, principally for promenade purposes, have for many years been skimmed over in the manner now being tried in New York. For instance, in some of our leading watering places—notably Brighton, I remember seeing it being done when the Gas Institution visited there, and also for many years past at Southport.

SAMUEL GLOVER.

*St. Helens, Nov.* 17, 1906.

## The Appeal for Funds of the Council of the Institution of Gas Engineers.

SIR,—The matter published in your last issue is very interesting and usefully suggestive; but, if I may presume to say so, it is rather in advance of the moment. With regard to the questions formulated, I take it that the answer to No. 1 is to be found in the majority vote in the affirmative of the members of the Institution; and the question we now have to deal with is the application of the powers given to the Council by the vote.

The first step, therefore, surely is to find a cause for the want of response to the appeal issued by the Council for support for an "Investigation Fund," so that, later, a remedy may be applied.

It it with no wish to discount in any way the previous work of the Institution—which I am sure has been carried out in its present form in all good faith—but with an honest endeavour to try and probe the "sore" for the cause, that I would ask you to give consideration to the following (possibly imperfect in some details) analysis of the circular as published.

Paragraph I. is general, and enunciates a very laudable ambition, but laments the lack of funds "to enable the Council to investigate many matters which would greatly benefit the industry."

Paragraph II. is also general.

Paragraph III. points out the duty of owners of gas undertakings as to providing funds required.

Paragraph IV. is an appeal for funds for instituting an "Investigation Fund." The use of the word "investigation" here is an important factor in considering the latter part of the circular. It also suggests a course of procedure.

Paragraph V. indicates the character of the work possible, with such funds available, and further specifies the direction to be taken.

The headings of the subjects chosen are marvels of "width," and may be subdivided as follows:—

| (A) Investigation. | (B) Management. | (C) Legal. |
|---|---|---|
| 1. Hygiene. | 2. Naphthalene (Difficulties due to). | 4. Parliamentary Requirements as to Standards, &c. |
| 3. Experiments showing the Advantages of Gas. | 5. High Pressure Distribution. | |
| 8. Tests of New Appliances. | 6. Improvements in Methods of Manufacture, &c. | 7. Legislation. |

Nos. 1, 3, 5, and 8 are subjects which materially lend themselves to investigation on a scientific or laboratory basis. No. 2 is somewhat difficult to understand as headed. The difficulties due to naphthalene are fairly obvious; the puzzle to most people is to unearth a reliable remedy. Nos. 4 and 7 are difficulties to place, in connection with an "Investigation Fund." No. 6 covers No. 1, 2, 3, 5, and 8 *in toto*.

Paragraphs VI., VII., and VIII. indicate the character of the special work undertaken by the Council during the past twelve months; but what connection the work detailed has with the proposed "Investigation Fund," it is difficult to see. The methods of testing illuminating powers are certainly questions requiring expert investigation; but the sentence commencing with, "In the result a new testing burner . . . has been prescribed," is surely elastic as far as the Council of the Institution is concerned. Mr. Carpenter, I take it, was working quite independently on the subject, in the interests of his own Company, in the first instance; and in doing so, he has placed the gas industry generally under a vast obligation. But where the Institution of Gas Engineers comes in, I fail to see, except as a "support" in evidence, of the opinion of the bulk of the members of the industry.

"The other matter" (Paragraph VIII.) cannot by any premise whatever be included under the heading of "Investigation Fund" accounts. It is a most important subject certainly, but surely one of policy (Board or Committee room policy); and any moneys required for such purposes ought to be payable out of some quite different fund. Here again the Council only ranked by their counsel as "support" in evidence.

Paragraph IX. "The great importance" of the work of the Institution is admitted freely by all with the best interests of the industry at heart; but the success of the appeal for support financially for an "Investigation Fund" as submitted by the Council in the circular issued is problematical, as it is without a definite objective.

If we are to succeed, let the fund be devoted to purposes of "investigation," and let other matters be dealt with (and the expenses incurred, paid for) out of a "Special Purposes Fund," or, as you now term it in your remarks, a "General Purposes Fund."

I trust the foregoing has not a "discursive" tendency, but will be of some service in the threshing out of the present problem, as to some subjects which might be included (and avoided) in the initiatory stages of an appeal for such a fund as was voted upon at the 1905 meeting of the Institution, upon the able report, with the recommendations contained therein, submitted by Mr. J. W. Helps.

JOHN HOLLIDAY.

*Hull, Nov.* 15, 1906.

## Special Purposes Fund of the Institution of Gas Engineers.

SIR,—Every one connected with the industry must agree that now is the time to take earnestly in hand the matter of technical research; and it is greatly to be regretted that there are several worthy objects brought at one time before the generously minded. Let us by all means keep each distinct, or all will become extinct so far as utility is concerned. The Leeds professorship is worthy of emulation, and other towns ought to attempt this if there is an available technical building. But can it be said that there the matter should end? Something more ambitious is needed; and besides local, we require national, representation on the staff of the country's scientists. Let the county institutions flourish on the efforts of inhabitants of local towns, aided, if possible, by help from the head body, but do not try and work without a head, or the various limbs will perform aimless evolutions.

I should not venture to offer suggestions but for your appeal to all to state their views. May I suggest that Mr. Brackenbury hits the mark when he indicates that the Institution has become "institutionized." They have become self-centred; and yet all will agree they did right in banishing the traders from their meetings. But the traders rely, for upkeep in business, upon the prosperity of trade, and would, I am sure, be only too glad to subscribe to a fund, if details were forthcoming of some practical scheme of technical research. In this matter then, why not seek their help?

(1) You ask contributors to consider "Is technical research desirable?" It always is in any trade, as all admit; and at the present time it is a fundamental necessity in the gas industry. We must continually progress to maintain the present position with the public; and progress is not only a movement forward, but means a rate quicker comparatively than that achieved by competitive systems of lighting, &c.

In the past, gas has maintained its pre-eminent position almost without effort on the part of inventors, and without doubt it has received no great help from any body or committee. Conditions are now changed, as the electrical industry is making a great struggle to get ahead, and, as a body of engineers, they do now, quite spontaneously without any organized help, what the gas industry is always slow to do. Private research by individuals has been encouraged by them, because they see they must use every improvement in process, employ all new aids, and adopt better plant when offered.

To get a new thing on the gas market is very difficult, and takes years to accomplish; but now that other systems of lighting are being pushed to the front by fair means and foul, we must have a recognized Research Committee to investigate new ideas and get these known to the members of the industry.

(2) "Which is the proper body to undertake the direction of the research?" With all respect to the Leeds University and to your gifted correspondent Sir George Livesey, there can only be one answer. The members of the gas industry must appoint a Special Committee from among themselves; and I do not see why the present Research Committee cannot do the work as well as any.

(3) "How best can that body be financed?" The reply to this is most difficult; but I give one or two hints, as they may be added to those likely to be furnished by more able contributors. It is pertinent to inquire who is to benefit by the research, because that party or parties should find the money. A large sum will be needed; and this will not be got if the Committee say right out that it is to be devoted to one object. I think an appeal on these lines would not bring in even a paltry £581 13s. The one object must, of course, be how best to better the gas industry as a whole, and what new methods to adopt of manufacture or process, improved means of using gas for lighting, heating, power supply, &c. Up to the present time, improvements have had to fight their way into the industry. Why not employ the Committee to search for such in the future, and help them to prosperity. I will make one or two suggestions.

(*a*) That the Committee, in strict confidence, examine all inventions or new schemes and give an expert opinion as to their merits.

(*b*) The inventor to pay (say) £2 2s. for this; and he would thus save the unknown but high cost of visits to patent agents, with the fees, payment for drawings, specifications, and other concomitants, not to speak of fees to Government. At present considerably more than half of the patents are for things already tried, or others which are not worth

trying. The Committee could in most cases give an opinion of value, and decide straight away if the idea was worth developing.

(*c*) If so, they would then approach (or let the inventor do so) several suitable competitive firms, who would put the invention on the market and agree to pay a royalty, to be divided equally between the inventor and the Committee. The invention would thus be "Hall-marked" by the Committee; and the industry would at once get the benefit of the improved process.

(*d*) All firms desiring to make use of the Committee to pay an annual subscription of (say) 10 guineas, which would be cheerfully paid. My idea is to foster the efforts of individuals, as it is from such effort that we get the new ideas and painstaking detail work which have resulted in wonderful improvements in all branches of life. Individuals need encouragement, and also look for material gain. Nothing is so bad as to have new ideas unappreciated; and what is nearly as bad, is to work for years at a subject and then find the new methods have been anticipated, or are not in conformity with the needs of the industry. By following the suggestions I have made, the Committee would tap two of the sources of revenue—quite new to the Research Fund; taking thus two classes who are to benefit by research.

The only other one from which money can be expected, as forming a class likely to benefit by good and immediate improvement in the trade, is that comprising the sellers—either companies or municipal bodies. From the former, I have no doubt great assistance would be forthcoming, as they have to look to their commercial existence, which is embodied in plant-betterment, cheapening processes of manufacture, or increased efficiency in distribution and lighting. From the latter, the help forthcoming cannot well be forecasted, although the outlook is more hopeful since the last elections. I submit that if these authorities see honest, well-guided efforts to encourage a forward movement in the industry, they will respond to the appeal for funds.

The gas manager and engineer does his part as it is; and surely it is only reasonable to expect that his employers will encourage research and investigation when they see it is going to help them to pay dividends or keep up the profits under the keener competition that will soon have to be faced. There is no way to force them to contribute; but let each gas company pay an annual subscription, which would entitle them to complete reports on the proceedings of the Research Committee. Let them know from time to time what value they are getting for their money; and if they are not satisfied, then they can cease payments. Once started, they would find the Research Committee too valuable to neglect. There would be no need of any pillory (either intentional or otherwise). Every company or corporation contributing, besides having the periodical reports and annual statement of accounts, might send a member as representative at the annual meeting of the Committee.

(*e*) The Committee might further aid inventors by giving an annual prize to the inventor of the best idea, or for the best work done in improving the industry.

There would as a matter of course be a lot of detail work to go through before the organization could be started—such as the amounts to be contributed by large and small companies. I am convinced that (later on perhaps, after a trial) your suggested way of levying a tax, as endorsed by Mr. Thomas Newbigging, would solve the difficulty. The "capital employed" basis would present some difficulties in companies that need not be mentioned; but a percentage of the annual make would only be just. This might be graduated if necessary, so as to make the payments by large and small companies and committees proportionate to the benefits likely to be received, and yet not too high in individual cases.

In conclusion, I may say it will give great pleasure to all interested in the gas trade to note from Mr. Dunn's letter that the disagreement (visible through the correspondence) between the Institution and the heads of the industry, has been caused through misapprehension, and is more apparent than real. His letter will clear this matter up, and show that the Institution know what they are striving for, and only need the assurance of funds. The desire to follow Sir George Livesey's excellent advice and subscribe to the professorship at Leeds shows how the Institution are only too glad to foster any idea having for its object the advancement of the industry. Your suggestion, in "Editorial Notes," that the condition precedent to the raising of funds shall be a guarantee to hand over a sum of money to the Leeds University, is the obvious solution of the difficulty; and it clears the controversy by bringing one main object before the members of the gas industry.

ARCH. S. B. LITTLE.

28, *Shrewsbury Road, Forest Gate, E.*,
*Nov.* 14, 1906.

[The explanatory letter from Mr. Walter T. Dunn, on behalf of the Council of the Institution of Gas Engineers, which appeared last week, came to hand too late for immediate reference in the editorial note to the correspondence. The letter shows that, although the Special Purposes Fund scheme had its origin in a suggestion made by Mr. Charles Carpenter, and that the Council had regarded the subject of the "Hygiene of Gas Lighting" as one of the first that should undergo investigation, on obtaining the necessary funds, the London Gas Companies subsequently decided to take this particular inquiry under their own wings; and unfortunately no communication was made to the Council to this effect until after the circular was issued appealing for funds. Perhaps the Council are themselves somewhat to blame over this matter, owing to the slow movement they made in acting upon the vote of the members in June, 1905. However, the Council have under consideration "other highly important subjects" requiring investigation, which come within the range of inquiry broadly outlined by their circular; and it is therefore still hoped that the fund will be speedily supplemented. We cannot shake off the feeling that apathy rather than the citing of a special subject for investigation is the reason for the miserable response to the Council's appeal for funds, and it is rather difficult to suggest a remedy for apathy in the case of people over whom one has no control. Mr. Holliday is hypercritical this week; and indulges in a review of the Council's circular that is not altogether complimentary to those responsible for it. If, however, Mr. Holliday is right that it is the form in which the appeal has been made that is the cause of the scant response, the simple remedy is to try a fresh form of appeal putting forward definite aims, though we cannot see why the Council of the Institution should be treated as irresponsible and incompetent in the utilization of funds committed to their care for research and inquiry which, in their combined wisdom, they deem will be of advantage to the industry. The Council of no other Gas Association in the world is so treated. But we are afraid if only one subject were named for investigation, many people in the gas industry would excuse themselves by saying: "We shall not subscribe, as that is not a subject that we think requires investigation." A broad list of subjects, on the other hand, should contain something to meet all views, assuming that all are agreed that inquiry of the kind is desirable. With regard to the questions we suggested that those entering upon consideration and discussion of this matter should first ask themselves, we would point out to Mr. Holliday that, although there was a majority vote at the Institution meeting in 1905 which supplies an affirmative answer to the first question, that majority vote is represented now by a subscription from a small minority of the authorized gas undertakings of the United Kingdom. Mr. Archibald Little contributes an interesting letter; but we are afraid his suggestion respecting one way of realizing funds would mean that the Investigation Committee would have to be a permanent and salaried one, for their time would be pretty well monopolized. It is pleasing to see from the letter from the Council of the Institution last week that the final paragraph coincides with the suggestion, regarding the Professorship of Fuel at the Leeds University, that appeared towards the end of the editorial note that was published on p. 471.—ED. J. G. L.]

**Petrol Gas Lighting in Scotland.**—Mr. William Key, of Ceres, Fife, writes to point out an error in the article which appeared under the above heading in the "JOURNAL" for the 9th ult. (p. 109), giving some particulars of the system of lighting by petrol gas which he has introduced there. The eleventh line from the end should read: "Before Mr. Key put *off* [not *up*] the coal-retort plant, he for two years had a splendid light," &c.

## The Lighting of Churches.

Referring to remarks on the above subject which were made by "Bypasser" in the "Ironmonger" for the 10th inst., as quoted in the "JOURNAL" last week (p. 481), a correspondent, whose letter appears in the current issue, says: "The problem of lighting our churches and public buildings to the best advantage is always with us; but this season it seems even more prominent than usual. The introduction of the inverted gas-burner is undoubtedly the moving cause. The great advantages of this mode of lighting are very rapidly being recognized. Its pretensions at first were very modest—namely, an absence of shadow, and the dispensing with chimneys and mantle-rods. But to these can now be added a greater economy in gas consumption; for, as compared with upright incandescent burners, with their elongated mantles, a saving of at least 1 cubic foot of gas per hour, coupled with an increase of 20-candle power in light, can be confidently looked for. One full-sized inverted burner will readily do the work of five flat-flame burners, and yet have the astonishing result of saving at least 25 cubic feet per hour in gas consumed. But let no ironmonger, plumber, or gas-fitter attempt the better lighting of a church unless he thoroughly understands the requirements of the inverted burner. Much disappointment may be caused by want of knowledge on this point. The conditions under which these burners will give the best results are not as yet properly understood by the great majority of those who undertake with a light heart to introduce and fix them; and, to make matters worse, the pressure from the main, which is the only important factor to be considered, varies in almost every case. What is wanted is closer study and more patience in adjustment."

**Oriental Gas Company, Limited.**—At the ordinary general meeting of the Company to-morrow, the Directors will report that the business in the twelve months ending the 30th of June last again increased over that of the preceding year; the total revenue being higher by £4391, of which some £3340 is attributable to gas-rental and the rest to residuals. The balance on the profit and loss account (after payment of the interim dividend and income-tax) is £21,230, out of which the Directors a dividend of 4½ per cent., free of income-tax; making a total of 8 per cent. for the year, and leaving a balance of £7730 to be carried forward.

**Portsmouth Water Company.**—At the half-yearly general meeting of the Company on Thursday, the Directors will report that the available balance on the profit and loss account is £28,483, out of which they recommend the payment of the full statutory dividends; also that a sum of £1358 shall be carried to the arrears of dividend fund, which, with £500 already standing to the credit of the fund, will enable a similar distribution to be made in respect of such arrears as on previous occasions. After the usual deductions for void houses, this will leave a balance of about £8681 to be carried forward. Reference is made to the withdrawal from the Bill promoted in the present session of the proposed scheme of extension, and to the passing of the measure in a modified form; and also to the rejection by the Corporation of the provisional agreement entered into to purchase the undertaking.

# MISCELLANEOUS NEWS.

## IMPROVEMENTS AT THE SMETHWICK GAS-WORKS.

### Opening of the New Railway Bridge and Sidings.

The new railway bridge and sidings which have been erected in connection with the Smethwick Gas-Works were opened last Wednesday afternoon, in the presence of a large assembly, by the Mayor (Mr. Edwin Adams). The total outlay in respect of the scheme—which has been carried out under the supervision of the Corporation Gas Engineer, Mr. Vincent Hughes—is £14,000. The bridge, which was illustrated in the "JOURNAL" for March 27 last (p. 859), is 15 feet wide and 150 feet long. It was supplied by Messrs. E. C. & J. Keay, of Darlaston; the rails and sleepers by Messrs. Hobrough and Co., of Gloucester; and the locomotive engine to be used upon it by Messrs. Peckett and Sons, of Bristol. The guests assembled at the works and proceeded to the new bridge and sidings, where the Mayor christened the locomotive "Chairman." His Worship then drove the engine over the bridge and back, after which he formally declared the bridge and sidings open. The visitors next crossed the bridge, and witnessed the operation of unloading the coal-trucks. This was followed by an inspection of the works.

At the conclusion of the business portion of the proceeding, the guests were entertained at a cold collation in the meter-house—the Mayor presiding. After the repast, the toast of "The Town and Trade of Smethwick" was proposed by Alderman W. H. Goodyear, and responded to by Alderman J. Whyman, who pointed out that the net capital debt on the gas undertaking was £160,385. This was followed by "The Chairman of the Gas Committee," proposed by the Mayor, who gave some interesting figures in regard to the gas-works. He mentioned that these were opened in 1881, at which time the late Sir Frederick Bramwell, the Engineer, strongly advised that the provision of siding accommodation should be considered. Definite action was not taken until 1890, when plans were submitted by the former Gas Manager (Mr. B. W. Smith), which were, however, of a modest character compared with the present scheme. At this period, the quantity of coal carbonized was 14,000 tons per annum. In 1896, this scheme was discarded as being impracticable; but in 1897 the Gas Committee resolved to construct a bridge and sidings, as the bulk of coal had increased to 21,000 tons that year. Unforeseen difficulties, however, arose; and in 1900 the management of the works was taken up by Mr. Vincent Hughes, one of the most competent men in the Midlands. The work of erection was not finally decided upon until 1905; it was actually completed in March last. The total length of the sidings from the Railway Company's line was 266 yards; and the cost—about £14,000—worked out at £52 per yard. The quantity of coal dealt with at the present time was 36,000 tons a year. They would save in haulage and rebate £1500 per annum; and if they allowed £1000 for repairs and maintenance, this would give them a net saving of £500 per annum. The Mayor went on to refer to the keen interest which Alderman C. W. Pinkney, the Chairman of the Gas Committee, had taken in the works. He said that during the six years Alderman Pinkney had occupied this position he had obtained a thorough grasp of the work. He was a practical man in the highest sense, and was an asset of intrinsic value. His engineering knowledge and expert advice had been at the command of the Committee in this and other works. Mr. T. Hedges, the oldest member of the Committee, supported the remarks of the Mayor. He said the name of Pinkney was well known in connection with patents in places where gas-engines were used; and while he had been Chairman of the Committee £50,000 had been spent on extensions at the works with a view of bringing them into a state of perfection. Alderman Pinkney had given his services freely, and they had been of the greatest value in carrying out these schemes. On behalf of the Committee, he presented Alderman Pinkney with two framed photographs of the bridge and sidings.

In acknowledging the toast, Alderman Pinkney spoke of the excellent manner in which the scheme had been carried out by the Contractors. He also paid a tribute to the work of Mr. Hughes in connection with it, as well as to his able management of the gas-works. Sketching the future proceedings of the Committee, he said they must get into operation every detail in connection with the works, and make them bear a full share in the profitable factor. It was not sufficient that they should spend a large amount of money in order to be in a position of safety. There was a great need for a reduction of their capital account; and they must never rest until this was done. He referred at considerable length to the competition which municipalities have to meet with regard to their gas undertakings, and said the Committee must be prepared to still further reduce the price of gas for power purposes if they were to compete successfully with suction gas and electricity. Their competition at present was not with steam. The efficiency of the best steam-engine it was possible to make was only 12 per cent.; whereas already with the gas-engine they had accomplished from 25 to 30 per cent. The charges for town gas had to cover capital and interest, which was a handicap they would have to overcome. He thought their charge for gas for motive purposes should be 1s. 3d. per 1000 cubic feet, instead of 1s. 5d. as at present. Electricity was a good competitor, and they must be prepared to meet it. Suction gas was another, and a serious one. There had recently been sent to manufacturers in the borough circulars containing diagrams showing the efficiency of the various systems, such as electricity, steam, oil, ordinary gas, and suction gas. Looking at these, a manufacturer would come to the conclusion that suction gas was the cheapest and the best for him to adopt; and unless he considered it very closely, he would be trapped. It worked out at 1s. 6d. per 1000 cubic feet; and he still thought they could afford to reduce the charge for ordinary town gas to 1s. 3d. The race was between suction gas and ordinary gas. The latter was in the race, and he felt sure it would come out all right. The Committee intended making numerous alterations in the future, and granting concessions to persons using gas for cooking purposes. He contended that the time had come when the illuminating standard of gas should be lowered. A gas of 13-candle power was quite good enough for anything; and if several municipal authorities who were similarly situated to Smethwick could go to Parliament and obtain special powers in this respect, they would be able to provide a splendid light with which no one could find fault, and yet save considerable expense. The past year had been a record one in connection with the gas undertaking; and he was looking forward to the future with much hope.

Other toasts were honoured, and the proceedings brought to a close.

## PREPAYMENT METERS IN BIRMINGHAM.

The Birmingham papers have of late contained a good many letters from correspondents on the subject of the liability of consumers for the damage done to slot-meters which have been broken open; and the interest that has been aroused in the matter has induced the local "Mail" and "Post" to publish some information regarding the prepayment system for the benefit of their readers.

The "Mail," after pointing out that slot-meter robberies usually occur at houses where the meter is placed in a pit inside the vestibule, says: So long as the position arranged for the meter is a reasonably safe one, the department cannot refuse to supply gas. Some four years ago, however, Mr. G. Hampton Barber, the Secretary of the Birmingham Gas Department, did his utmost to get landlords to discontinue the provision of vestibule pits for gas-meters; and as a result no houses of recent construction have been so supplied. In the majority of instances, the meter is placed in a corner of a sitting-room or in a chamber behind the front door; so that anyone attempting to force the meter-box would have to get inside the house, and in the latter case close the door before commencing operations. As far as the pits that are in existence are concerned, attempts have been made to induce landlords to affix hinges to the outside edge of the covering board. As to consumers being called upon to pay for the damage done by thieves, every consumer who uses a penny-in-the-slot meter signs an agreement binding himself to make good any deficiency that there may be in the meter-box. Any surplus (and there is often a considerable amount) is to be handed over to the consumer; and at the same time he holds himself liable for any damage to the meter caused by thieves. He must also give three days' notice if he is leaving or desires to discontinue the use of gas. About three years ago, printed post-cards were sent out to all consumers for the purpose of giving notice of removal; and at the present time four cyclists are in the employ of the department, whose duty it is, on receipt of such notices, to ride immediately to the house and collect the money from the meters. Some people have complained that the department refuse to take out an automatic meter and put in an ordinary installation. But it must be borne in mind that to fit up a house on the automatic principle necessitates an expenditure of about £5; and it would be hardly fair to ask the ratepayers to pay the cost of making changes to suit individuals. Not long since, the automatic system was, at the request of a property owner, removed to suit a tenant. A few weeks later, there was a change of tenancy; and the department was asked to reinstal the penny-in-the-slot meter. Unless some regular system of procedure were adopted, it is patent that the department might be continually changing and re-changing the methods of installation, at the ratepayers' expense, to suit the whims of individual consumers. In respect to the question of charging users of gas with the cost of repairing damage to meters, the amount charged, as explained by Mr. Barber, is merely nominal, and does not represent the actual cost to the department. This step had to be taken some time ago, owing to the large number of broken locks; and cases of damage done have diminished since then. The income from these meters now amounts to about £50,000 annually; and as showing how popular they are with the public, new applications for installation come in at the rate of about 6000 a year.

The "Post," referring to the arrangements made by the city authorities "in order to ensure that the householder gets all the gas he pays for," says Birmingham possesses one of the most modern and best-equipped plants for the testing of meters in the country. The department is situated in Sheep Street; and last year something like 51,000 meters were there examined and officially registered. This number represented all classes of meters; but the great proportion were those which work automatically when the "nimble penny" is placed in the slot. Last year's return was the record since the establishment of the system in 1890, when the number of meters tested was 9737. Each succeeding year saw an advance; but it was not until the advent of the penny-in-the-slot meter that the development assumed abnormal proportions. Birmingham is to-day participating largely in the profits arising from the manufacture of the penny automatic gas-meter. Her product is finding its way far beyond the confines of this country, to many parts of the Empire, and even to the Far East. John Chinaman has taken to buying his illumination by the pennyworth, and is showing, notwithstanding his usual incredulity to mechanism which he does not understand, implicit confidence in the Birmingham-made meter. In the houses of Birmingham and district, 47,000 penny-in-the-slot-gas-meters have been installed; and they are being added to at the average rate of something like 7500 each year. The testing of meters of all kinds is carried out under the direction of the Birmingham Justices. It is a requirement fixed by the Legislature in 1859, when the city was supplied with gas by the Birmingham Gas Company and the Staffordshire Gas Company. The meter-testers were the officials of the Markets and Fairs Committee, who had premises in Moor Street; but when the Corporation acquired these undertakings, and municipalized the gas making, the duty of the Committee was conferred upon the local Justices as an independent authority. There is perhaps no more maligned piece of mechanism, especially during the dark days of late autumn and winter, than the gas-meter, as distinct from the penny-in-the-slot variety. If the gas bill shows a big advance over the last which reached him at the corresponding time, the worthy householder thinks vindictively of the innocent-looking red box under the stairs or in the cellar, ticking away remorselessly so long

as a single gas-burner is alight in the house; and he straightway unburdens his soul to the newspaper, or declares in a complaint to the Gas Department that the meter is out of order. An expert examines it, and pronounces it to be in good working condition; and the householder grumbles and pays. The officials at the Gas Department declare that in twenty-nine cases of the thirty in which complaints are made respecting excessive charges, the meters are found upon examination to be in proper working order. Defective fittings and leakages provide by far the most frequent explanations. The profits of the meter-testing undertaking are devoted to the relief of the rates. These have gradually increased from £107 in 1890 to £727 last year, when the gross income amounted to £1474. The introduction of the penny-in-the-slot meter dates from 1895, when the figures of meters tested increased from 9435 to 13,311, and again in 1896 to 17,743. The Sheep Street department was entered in 1898, when over 20,000 meters were examined, and two years later this figure had advanced to 29,079, in 1902 to 37,582, and in the following year to 47,306. The year 1904 saw the completion of the costly testing plant, which had, of course, kept down the balance payable towards the relief of the rates. In the absence now of such demands on current revenue, the net profits have advanced in much greater proportion than before. But this is not all. The official hall-mark of the Birmingham Magistrates is accepted everywhere as evidence of the accuracy and efficiency of the meters; and locally their manufacture has thus been greatly facilitated. The penny-in-the-slot meter has really created a new industry with enormous possibilities.

## RATES AND GAS, ELECTRICITY, AND WATER CHARGES.

We have received from Mr. James Carter, the Borough Treasurer of Preston, a copy of his tabulated statistics of the rates levied and collected, and the charges made for gas, electricity, and water, in a number of Provincial towns and a few Metropolitan boroughs, for the year 1906-7. There are in all 89 places referred to, which is the same number as in the previous compilation. The populations range from 739,180 (Liverpool) down to 20,878 (King's Lynn). The rateable values are highest in Westminster (£6,074,395), Liverpool (£4,587,393), and Manchester (£4,139,619); and lowest in Bacup (£84,626), King's Lynn (£84,777), Brighouse (£87,636), and Stafford (£89,790). The places most heavily rated are: West Ham, 10s. 4d.; East Ham, 9s. 7d.; Norwich, 9s. 5d.; Halifax, 9s. 4d.; Middlesbrough, 9s. 4d.; Bradford, 9s. 0d.; Dewsbury, 9s. 0d.; Rotherham, 9s. 0d.; Wakefield, 9s. 0d.; and Wigan, 9s. 0d. Those which have the lightest rates are: Oxford, 4s. 6d.; Lancaster, 4s. 10d.; and Bournemouth, 5s. 0d. Out of the rents of property and profits transferred from municipal undertakings, the rates are reduced in the following towns to the extent named: Carlisle, 1s. 10d. in the pound; Warrington, 1s. 7¼d.; Macclesfield, 1s. 5½d.; Stockport, 1s. 3¾d.; Nottingham, 1s. 3d.; Rochdale, 1s. 3d.; Darlington, 1s. 2½d.; Leicester, 1s. 1d.; Blackpool, 1s. 0d.; Dewsbury, 1s. 0d.; Liverpool, 1s. 0d.; Salford, 1s. 0d.; and Stafford, 1s. 0d. Blackburn relieves the rates to the extent of ½d. in the pound; Bournemouth contributes ½d.; Darwen, ½d.; South Shields, ½d.; Bootle, ¾d.; Sunderland, ¾d.; Wakefield, ¾d.; and West Hartlepool, ¾d.

Coming to the table giving the charges for gas and water, we find that the price of the former for domestic supplies is again highest at King's Lynn—3s. 6d. per 1000 feet; and Widnes is once more lowest with 1s. 3d. per 1000 feet (while there is, of course, an even lower rate for very large consumers and engines). The following towns also enjoy the privilege of a gas supply at 2s. 0d. or less per 1000 cubic feet: Plymouth, 1s. 9d.; Gateshead, 1s. 9⅜d.; Newcastle, 1s. 10⅛d.; Belfast, 1s. 11d.; Bury, 1s. 11d.; Sunderland, 1s. 11d.; Bradford, 1s. 11⅜d.; Bath, 2s. 0d.; Bristol, 2s. 0d.; Darlington, 2s. 0d.; Lancaster, 2s. 0d.; and Tynemouth, 2s. 0d. The charge per B.T.U. for domestic supplies for electricity ranges from 6d. at Barrow, Blackpool, Brighouse, Bournemouth, Coventry, Dudley, Heywood, Leamington, Lincoln, Reading, Rochdale, and Stockton-on-Tees, down to 3⅜d. at Bootle. The charge for water for domestic purposes on a house of £15 rateable value is highest at Bury, Heywood, Rochdale, and Rotherham—2s. 0d. in the pound. It is lowest in the following towns: Bootle, 6d.; Liverpool, 6d.; Manchester, 8d.; King's Lynn, 8½d.; Brighton, 9d.; Leamington, 9d.; Kensington, 9⅛d.; Islington, 9⅜d.; and Westminster, 9⅜d. The other places in which the charges are less than 1s. are Birkenhead, Bournemouth, Oxford, Plymouth, Reading, Salford, Widnes, and York. At Preston (Mr. Carter's own town), the local rates are 8s. 11d. in the pound; and they are relieved to the extent of 7d. by the rents of property and the profits transferred from the reproductive undertakings. The price of gas is 2s. 11½d. per 1000 cubic feet; of electricity, 4½d. per unit; and of water, 1s. 2d. in the pound on £15 houses.

There is a table showing the amount estimated for the current year to be transferred to the borough, district, or other fund from the various profitable undertakings.

**Scamped Gas-Fitting.**—In the "Trade Chat" in the current number of the "Ironmonger," "Vulcan" writes as follows on the above subject: "The death of three little children in Whitechapel, owing to an escape of gas from a pipe which had been repaired by means of a short piece of rubber tubing, instead of the joint being properly sweated, calls attention once more to the necessity of all plumbing and gas-fitting work being rigidly inspected before it is passed. The man who repaired the pipe in question deserves indictment for manslaughter if he can be found; but in cases like this the culprit usually escapes scot-free, owing to the time which elapses between the doing of the scamped job and the occurrence of fatal consequences. If, on the other hand, plumbing repair work were as carefully inspected as new work now is in many places, the risk of accident would be very materially reduced. Meantime, it might serve as a wholesome check on scamping if severe penalties were imposed on all who are in any way responsible for boggling work which involves risk to life."

## SOUTHAMPTON GAS COMPANY.

The Half-Yearly Meeting of the Company was held last Wednesday week, under the presidency of the Chairman—Captain A. J. Corse Scott, J.P.

The Secretary (Mr. E. W. H. Eady) having read the minutes of the previous meeting, the report of the Directors was taken as read.

The Chairman said the shareholders would be glad to hear that the last half year had been a prosperous one, and he might also add an eventful one. The amount of profit available was £15,784, which was £3307 more than the sum required to pay the maximum dividends. The Directors had therefore thought it wise to make a further addition of £2000 to the reserve fund, which now stood at £47,559. There was an increase of 12,664,000 cubic feet in the quantity of gas sold during the half year, which was a gratifying testimony to the progress and growth of the Company's business. Not only had the number of ordinary consumers satisfactorily increased, but there had also been made the considerable addition of 1000 slot-meter consumers throughout the Company's district during the six months. The popularity of both gas-fires and gas-cookers had been well maintained; and the use of gas in this direction promised to still further increase. As it was clearly to the interest of the Company that consumers should be enabled to obtain the best results possible from incandescent gas-burners, the Directors had established a new department for the periodical inspection and renewal of mantles and burners, and also of gas fires and cookers. A considerable number of consumers had already availed themselves of this opportunity to ensure proper and efficient lighting and inspection, for which a nominal quarterly charge was made. Although the stockholders were formally apprised at the extraordinary meeting held last September of the success of the Directors in obtaining a new Act of Parliament, he thought this a suitable opportunity of bringing before the notice of those present the advantages which the Company had secured by the Act. Judging from the advice of their Engineers, the Directors felt assured that the Act had authorized the Company to raise from time to time sufficient capital to last for many years. The Directors thoroughly believed in meeting any threatened opposition in a just, equitable, and amicable spirit; and they were glad to state that, in pursuing this course, they met with the fullest courtesy and consideration from the Southampton Corporation, who were the only opponents of the Bill. As a result of the conference between themselves and the Corporation, there was a fair amount of concession on both sides, which ended in the Bill being passed unopposed. The last Act obtained by the Company, being opposed, cost over £4000; while the present one had been obtained for less than one-fourth of this sum. It had been a source of gratification to the Directors that the first issue of stock under the new Act was very considerably over-subscribed—£7000 being asked for, and over £12,000 being tendered, at the very good price of £112 per cent. As, however, this price would return the stockholders nearly 4½ per cent., the Directors felt that the allottees had secured a first-class investment on reasonable terms; and stockholders who did not apply could not but feel gratified at the present market value of their holdings, which compared most favourably with many of the best stocks in the kingdom. He now came to another eventful point in the history of the past half year. As the proprietors were aware, for many years in the past the Company had been very highly rated; but their prosperity, he must admit, justified the Guardians in increasing the assessment. The last time this was done, the Company had a hard battle to fight, and went to appeal on the subject, with the result that they then won, and succeeded in reducing the enormous increase proposed. It, however, cost the Company a great deal of money; and what it cost the ratepayers he could not say. On this occasion, they wished it to be generally known that the Guardians met the Directors in no unfriendly manner; and as the result of a conference between them and the Rating Committee, the Guardians' valuers' proposed increased assessments of £3172 were amicably reduced by agreement between the parties to the additional sum of £2500 only. While the Directors admitted that in a successful and prosperous Company such as theirs increasing assessments were just and inevitable, they felt that in conceding an increase of £2500 they had met the full rateability of the Company, and thereby had enabled the Guardians to decrease by 1½d. in the pound the charge to the ratepayers generally. Some people, however, were inclined to think the Company were not rated high enough. The Directors believed they were; and though, as he said, they did not want to fight, yet, if they were bound to do so they were prepared for it. As he had intimated at previous meetings, for several years past the Directors had made it a point to hold their meetings periodically at the gas-works, and after they had concluded their Board business to thoroughly inspect the works. As Chairman, he was glad to report that at their last inspection both himself and his colleagues on the Board were exceedingly pleased with the general condition of the works, which testified to the care which the Manager (Mr. S. W. Durkin) and his son (the Assistant-Manager) had exercised in keeping all the plant and apparatus in thorough efficiency; and he had not the slightest doubt that whatever strain might be laid upon the works by the demands of the coming winter season, they would be fully met. He concluded by moving the adoption of the report and accounts.

Mr. Moberly seconded the motion; and it was carried.

The payment of the maximum dividends having been agreed to,

Dr. Bencraft, in moving a vote of thanks to the Chairman and Directors, said the making of financial arrangements with Corporations and the promotion of Bills in Parliament were matters of difficulty, and required a great deal of skill and tact; and the Directors were to be congratulated on the success they had met with. They knew that law proceedings were oftentimes very costly, and also unsatisfactory to someone; and they could therefore congratulate the Board that they had been able to settle matters satisfactorily, to the best interests of the Company as well as of the ratepayers. It was very pleasing to be able to get the new Act through Parliament without opposition; and he thought the whole of the shareholders would appreciate what had been done with regard to that, and also that they had been able to arrange the rating matter without having recourse to an appeal, which would

not only have been an expense to the Company, but also to the ratepayers.

The motion was carried by acclamation; and the CHAIRMAN briefly returned thanks.

A vote of thanks to the Secretary, Resident Engineer and Manager, and the staff generally, concluded the proceedings.

## NOTTINGHAM GAS CONTROVERSY.

It will be remembered that, by a recent vote of the Council, the appointment of the Gas Committee was taken out of the hands of the general body of the Corporation and relegated to the General Purposes Committee of the Municipality, composed of the Chairman or Vice-Chairman of the chief Committees of the Council. They have, in the exercise of far-reaching powers, been content with no half-measures. Dr. Milner, for his temerity in supporting the Engineer (Mr. J. H. Brown) against the recent avalanche of party attacks, has been removed from the Committee, and this despite the fact that at the contest in which he was successful on the 1st of November, he made the gas question one of the main points in his propaganda, and, in an essentially working-class constituency, was returned by a record majority. The political powers that be have not, however, limited their wreaking vengeance process to the Doctor, whose main cause of offence appears to be that he has not hesitated to remind the Council that in Mr. Brown the ratepayers possess the advantage of the service of one who has built up the gas undertaking to efficiency from a condition of comparative chaos. They have exercised their strength also to the extent of eliminating from the Committee the name of Councillor Albert Ball, another Conservative member, whose brother is Sheriff of the city for the present year. The former Chairman of the Committee, Mr. E. Harlow, who resigned conjointly with Alderman J. Jelley and Mr. R. Sands, no longer finds a place in the list, nor does Mr. Sands return to the Committee; but Alderman Jelley has been again chosen. Alderman Bentley (Conservative) and Alderman Bexon (Liberal) have been dropped, so that there are in all six changes in the Committee compared with that elected in November, 1905. The list is now made up of the Mayor (Alderman J. A. H. Green), Aldermen Sir John Turney (who presided over the Special Committee of Investigation), Truman, Jelley, and Ford, Messrs. Ashworth (who has been acting as Chairman of the Committee since the withdrawal of Mr. Harlow), Cleaver (ex-Mayor), Mellor, Fleeman, Loverseed, Spalding, and Dr. Brown Sim.

In municipal affairs, as at the card table, when people lose their tempers they show their hands; and in the involved history of municipal administration there has probably never been a more striking instance of the truth of the aphorism than is presented by Nottingham's case to-day, as afforded by the constitution of the new Committee. The thing is flagrantly bad. The political wire-pullers, as represented by the present majority on the Council, have in effect said that this and that man must no longer be permitted access to possible sources of information as to inner details. It is hardly to be wondered at, therefore, that Dr. Milner, at a meeting in connection with a bye-election which is pending in the city, availed himself of the opportunity of dealing with the topic in no unmeasured terms. Speaking on Wednesday evening in Robin Hood Ward, in support of the candidature of Mr. H. Gover Ford (who is endeavouring to secure the seat formerly occupied by the new Mayor, who has been raised to the aldermanic bench), Dr. Milner characterized the removal of his name from the Gas Committee as an underhand and disgraceful proceeding. He also revealed another element in the situation by the declaration that it was only after great pressure had been brought to bear that Alderman Ford, after about 29 years' service, was allowed to again serve on the Committee of which he was Chairman after the retirement of Alderman Barber. Mr. A. Ball, at the ward meeting referred to, also denounced, as being unworthy of gentlemen, the action which had been taken in regard to his removal from the Committee.

Protests of this character may possibly for the time being be regarded as comparatively unavailing. But the opinion is apparently growing in Nottingham that the largest trading concern under municipal control is of too great importance to be made the battledore and shuttlecock of party politics. Whatever the grumbling may have been in the past, it is admitted that Nottingham consumers of gas are to-day obtaining a medium of illumination which represents fair value for money. It is being strongly insisted upon that, previous to the administrative *régime* for which Mr. Brown is responsible, much in the way of supposed efficiency existed on a paper basis only. Like the Irishman's gun, the whole system had to be repaired—lock, stock, and barrel. And, forsooth, because it could not be accomplished in a trice, the new Engineer was to be made the scapegoat. If the ratepayers had been scrupulously careful in their selection of disinterested representatives, there might not have been so much trouble as is involved in a matter, essentially of local bearing, but threatening now to develop into a phase which calls for higher authoritative interference, if statutory means can be found.

Formal confirmation by the Council is necessary as to the new Committee; but this, it is obvious, will be forthcoming. The majority on the Corporation will exercise its voting powers at the bidding of its leader; and in this sense their action will be consistent. But, at what a sacrifice of such regard to municipal dignity as yet seems to remain, future developments may disclose. It would be easy to pull to pieces by serious argument the motives actuating the new appointments. One thing appears above all certain, and that is that Mr. Brown is likely to find no special pleader in the inner court, where there are so many who are solicitous of saving the political positions of their friends. The Gas Engineer would not stand in need of any special advocacy, if the whole of the circumstances were allowed to be made known. He has been, so far as information is available, the first to welcome the suggestion that the evidence given before the Special Committee of Investigation should be placed at the disposal of the President of the Local Government Board. The other witnesses before the confidential tribunal presided over by Sir John Turney have also expressed their acquiescence in this course; so that Mr. John Burns will have much interesting material to assimilate.

Meanwhile, there is something which ought not to be lost sight of as to the development of Nottingham's chief trading concern under judicious engineering control. It might be as easy, under given circumstances, in regard to municipal undertakings, as to private companies, to inflate returns on one side of the ledger; but figures applicable to the Nottingham gas concern are capable of verification. While the record is one of economic working, it has not been at the expense of efficiency or want of substantial satisfaction to the ratepayers. There is, significant of reduced cost, a passage in the last annual report of the Engineer which established the fact that, during the period under review, carbonizing expenses per 1000 feet of gas sold had fallen from 2·92d. in 1905 to 2·67d. in 1906, figures which constituted the lowest on record. There was an increase of 1·73 per cent. of gas sold during the year, which afforded ground for satisfaction in view of the further extended use of incandescent gas-burners. But, apart from all the details involved, the following figures, as representing the amount of the gross profit earned under Mr. Brown's management, are eloquent of remunerative working: 1902, £75,907; 1903, £89,141; 1904, £97,037; 1905, £91,941; and 1906, £101,221. Analyzing the results in another form, it can be established that from 1902 the totals to funds in aid of the rates, and to consumers in the respective years under consideration, are represented by these figures: 1902, £25,016; 1903, £37,388; 1904, £64,648; 1905, £64,975; and 1906, £72,733. And yet, if they can be allowed their way, the man who has been mainly responsible for these financial results is to be professionally ostracized at the dictates of a splenetic caucus.

## GAS-MAINS UNDER TRAMWAYS.

### Arbitration Proceedings.

At the Westminster Palace Hotel last Thursday, arbitration proceedings were commenced before Mr. H. GRAHAM HARRIS, M.Inst.C.E., to settle a difference which has arisen between the Hastings Tramways Company and the Hastings and St. Leonards Gas Company in respect of a notice given by the latter, under section 30 of the Tramways Act, 1870, requiring the Tramways Company to remove the mains and pipes under the tramways now in course of construction at Hastings from the Bo-Peep Hotel, St. Leonards, to Queen's Road, Hastings.

Mr. C. C. HUTCHINSON and Mr. W. FLETCHER MOULTON appeared on behalf of the Tramway Company; and the Gas Company were represented by Mr. G. WOOD HILL and Mr. E. HUMPHREYS.

Mr. *F. H. Abent* who superintended the main-laying for Messrs. John Aird and Sons, was the first witness called. He said his experience had been that if the gas-mains were permitted to remain under the tramways at Hastings, considering the nature of the subsoil, there would be danger to them. The effect of vibration would be very nearly the same upon a 12-inch as upon a 30-inch main; and he was afraid that it might move a pipe and break the joint. Generally speaking, nearly all the trunk mains, both for gas and water, had been removed from beneath the tramways in the South of London, and he had no doubt as to the reason for this being done.

Mr. *Charles E. Botley*, the Engineer and Manager of the Gas Company, stated that the subsoil along the Hastings roads was most unstable ground. There was a great deal of vibration from tramways which had a solid bottom; but where the foundation was not sound, there was excessive vibration, and the subsoil, which in Hastings was composed of fine sand, was liable to settle down, and leave the ground hollow. What he complained of was that tramways set up vibration, and the pipes laid beneath them were consequently damaged.

In reply to questions by Mr. HUTCHINSON, witness said he would have been satisfied with a concrete bed 12 inches in thickness underneath the tramlines. If this had been provided, the question would have been settled. Vibration in the present case was set up by a tramcar running continually over the same place with a narrow wheel. Along solid roads, a bed of concrete 6 inches thick would be ample protection to the pipes. The Gas Company had 100 miles of mains, and for many years the leakage had been 4 per cent.; but since the tramways had come into existence it had gradually increased, until at the present time, it was nearly double.

Mr. *F. Fox* pointed out that the gas-mains were not in a position to be safe from injury from the tramway, and he said they also constituted a sort of explosive magazine in connection with the electrical workings. Some steps should be taken to minimize the danger, as had been done in many other cases. Having regard to the fact that the mains were known to be in a certain position in the road, there was not a worse place in which the tramlines could have been laid.

Mr. *Joseph Cash*, the Engineer and Manager of the Brighton and Hove Gas Company, in answer to Mr. HUTCHINSON, contended that the effect of vibration from tramways had been to damage the larger mains which were underneath the track, and to fracture the smaller ones. Motor omnibuses created vibration; but the effect was different from that caused by a tramcar—this giving more vibration.

Mr. *H. E. Jones*, giving evidence on behalf of the Tramways Company, said that nowadays gas-mains were being laid at a greater depth than formerly; but since the making of electric tramways, it was not his experience that the leakage of gas had increased to any extent.

Mr. *T. B. Holliday*, the Engineer and General Manager to the Tramways Company, said that previous to the laying of the tramways an opening was made exposing a gas-main; and when he afterwards examined the place, he found that the subsoil had fallen away from the concrete. This was probably due to the opening having been improperly filled in.

Mr. *S. Sellon* expressed the opinion that the pipes under the tramway were not in danger. He considered that 6 inches of concrete was sufficient covering for the pipes; and under such circumstances he did not know of a single case where a pipe had been fractured.

The hearing was then adjourned till next Friday.

## THE COAL-TAR INDUSTRY OF AMERICA.

The presence in America, a short time ago, of Sir W. H. Perkin, to take part in the celebration of the fiftieth anniversary of the discovery by him of the colour mauve, on which the subsequent development of the coal-tar chemical and colour industry was based, led our contemporary "Engineering Record" to publish a few statistics of tar production, from which we take the following particulars.

The production of tar in the year 1904 from gas-works and bye-product coke-ovens in the United States was 70 million gallons. Of this, 60 per cent. was from the gas-works and 40 per cent. from the coke-ovens. If we go back to 1895, which is before the tar from coke-ovens had become an important factor, and allow for the increase of production in 1905, America's tar output has been increased 3½ times in the last ten years. This corresponds to an annual increase of about 13 per cent. The fact that the industry has taken care of such an annual increment of raw material, practically thrown on its hands for so long a time, and without having to resort to the lower-priced products—as, for instance, fuel pitch for briquettes, into which so large a proportion of the English and Continental tar is made—is convincing evidence that the demand for the American-made coal-tar products is genuine and permanent, Furthermore, it shows that the articles produced are well suited to existing architectural and engineering needs. Such results do not come about fortuitously, but demand keen and patient study.

Until the advent of the bye-products coke-oven, the tar supply of America was far short of what it might readily be expected to absorb. This condition was due in part to the widely extended use of carburetted water gas in place of coal gas. This relative scarcity of tar is shown by the importation of tar and pitch in 1895, amounting to 116,000 barrels. In the year 1905, this had fallen to some 46,000 barrels, or less than half, instead of an increase, which might have been expected under ordinary conditions. It is therefore not to be wondered at that the American industry, in the face of this enormous influx of crude tar, has hesitated to attempt the organization of an industry so complicated as the making of drugs and dyes. The natural tendency is to seek profit by the shortest and simplest methods, so long as they can be made remunerative. The coal-tar chemicals, furthermore, absorb but relatively small quantities of tar when compared with the cruder uses. Benzol, which in Germany is so largely extracted from the coke-oven gas, for the use of the chemical works, is usually needed in the gas in America, where it is used for illuminating purposes, especially since the legal candle power required in American cities is apt to be higher than that required abroad. In neither England nor Germany, moreover, has so much progress been made in the use of coke-oven gas for ordinary city distribution as in America.

Whether or not the country will eventually take up the manufacture of aniline colours and chemicals it is impossible to say. Reasons for not doing so have been advanced, as, for example, the alleged scarcity of competent chemists willing to work for the moderate recompense paid abroad, and the strong entrenchment of the industry in the hands of German companies. Some refined benzol and toluol, also oil of myrbane and naphthalene in different forms, are made at Philadelphia; and some alizarine and aniline products are produced elsewhere. These beginnings may be the foundation of larger things. Whether the next decade will still see Americans outsiders and onlookers in this branch of manufacturing enterprise, must be left to the decision of time.

## Gas and Electricity at Colwyn Bay.

A somewhat amusing reason for the adoption of public electric lighting was put forward at a meeting of the Colwyn Bay Urban District Council, when the Lighting Committee reported that they had reconsidered the proposal to light Abergele Road with high-power gas-lamps, instead of with electric arc lamps; and they now recommended that one of the high-power lamps be put up as an experiment. The Rev. W. Hughes disagreed with this proposal, and moved an amendment in favour of the road being lit with electric arc lamps. He declared that the East-end inhabitants would not be satisfied until they got fair treatment. At the West-end, the main road was provided with arc lamps, "and these gave a tone to that part of the town. The moment that visitors came in and saw that the West-end was lit by electricity and the East-end by gas, they concluded that the gas-lit end of the town was inferior." Mr. Bevan declared that the longing for arc lamps was purely sentimental. Gas-lamps with incandescent burners were decidedly cheaper, and decidedly superior in lighting power. The Council ought not to endorse this policy of arc lamps. When the electric lighting system was inaugurated, the Council intended merely to illuminate the heart of the town by electricity. The amendment was, however, carried by nine votes to five; and Mr. E. H. Davies then asked whether the arc lamps at the West-end could not be forthwith removed. From a ratepayer's point of view, he said, it would be far better if they had gas throughout the town. Mr. W. Davies: I quite agree with that.

**Gas-Works Extensions at Mansfield.**—Mr. H. R. Hooper, last Thursday, on behalf of the Local Government Board, continued his inquiry into the application of the Mansfield Corporation for sanction to borrow, among other sums, £15,000 for the purposes of their gas undertaking. At the outset, however, the Town Clerk (Mr. J. H. White) intimated that the Corporation had decided to reduce this sum to £13,500 by doing without the proposed exhauster and sulphate plant. During the inquiry, the Inspector pointed out that sanction would not be granted where money had been expended upon the salaries of permanent officials. A number of payments in this respect had been made to men whom he regarded as permanent officials. The Town Clerk thought this was unusual, as the men in question were merely foremen of works. The Inspector, however, replied that it was quite usual with the Local Government Board; and the rule had been in force for some time.

## LONDON COUNTY COUNCIL AND ELECTRICITY SUPPLY.

### A Change of Front in the Trust Scheme.

Referring to the proposal of the London County Council to launch upon a big scheme of electricity supply, to which our readers' attention was specially directed last week, the Special Representative of the "Pall Mall Gazette" says: In view of the elections next March, the Progressive majority on the London County Council have begun the painful process of climbing down from their lavish proposals. Already we have seen this process at work in the cutting-down of the new tramway expenditure and in the delegation of duties to the Education Committee; and now they have under consideration an extraordinary modification of their electrical trust scheme, by which the distribution of energy, which was to have entailed an outlay of two-and-a-half millions, is to be handed over to a private corporation, and the generating station only is to be proceeded with—the object being to lease it to a company that will undertake the distribution.

The Progressives who are putting forward this modified scheme, and calling it a compromise, appear to be flattering themselves that it will be acceptable to the Municipal Reform party. In the first place, however, it may be stated that no such proposal has been submitted to the Reform leaders; and in the second, that it is not at all likely to receive from them the slightest encouragement. It was estimated, when the proposal was brought forward, that the generating-station would cost something like a million-and-a-half. This sum, or any part of it, if allowed to be spent, will be utterly wasted. The contention that the establishment of a generating-station is necessary in order to secure control over electrical supply in London is absurd. If the County Council are anxious to secure control, they can have it without wasting a penny. All that would have to be done is to bring into force for the electric supply companies the same system as that which operates in the case of the gas companies—a system by which tests of purity are made periodically, and the price to consumers regulates the profits.

The fact is, the original extravagant proposal cannot be so readily cut in two merely to suit Progressive electioneering policy. If it is true, as stated, that the modified scheme has the support of leading members of the party, all that can be said is that it is quite contrary to the views expressed by Mr. M'Kinnon Wood and his followers at the meeting of the Council at which the proposal was sanctioned. There is no doubt, however, that the party are seriously fearing the effect upon the electors of their latest proposal, and nothing is now left of the courage with which, ten days ago, it was so rashly brought forward.

## OFFER TO BUY THE BATH ELECTRIC LIGHT WORKS.

The Bath Electric Light Committee met last Tuesday to consider an offer to purchase the undertaking; and they appointed a Sub-Committee to make inquiries and report. The Town Clerk, on being interviewed, stated that this was all the information he had to communicate; but the "Bath Chronicle," in a lengthy article, says that during the previous week a letter was received by the Town Clerk from influential London financiers offering to purchase the undertaking upon terms which, in the opinion of many, the city rulers would do well to accept. The gentlemen on behalf of whom the offer is made are, it is understood, Mr. Schenk, a German electrical financier, and Mr. J. M'Gregor, also well known in the same circle. They are the promoters of a very big undertaking, the principal object of which is the acquisition of the powers of the Somerset and District Electric Power Act, and also those possessed by the Bath Corporation. The Somerset and District Electric Power Company some three years ago obtained their Act, which enabled them to supply electricity to a very large area, stretching to the boundaries of Bath as well as of Bristol. The Bath Corporation spent a considerable sum in opposing the Company's effort to obtain statutory powers in their area. Referring to the financial side of the question, the "Chronicle" says:—

The works have cost the city up to date quite £158,697. There can be no getting away from this substantial total. Since the period to which the latest abstract of accounts applies (March 30, 1906), £18,120 more has been borrowed, and authority has been received to borrow a further £4000, which formed the subject of a recent Local Government Board inquiry. This was for the Stothert and Pitt extension, which has been carried through, and their works are now being supplied with current from the Dorchester Street station; so the £4000 loan for which authority has been received, or the bulk of it, would have to be added to the £158,997. Then in the same abstract appears £23,669 "amount repaid or set aside for repayment." Well, the offer includes consent that this amount should remain in the redemption fund; and the promoters of the new enterprise will hand over the £162,697 and £20,000 bonus in addition. What does this mean? That not only will the £20,000 be received for the benefit of the city, but whatever actual figure the £23,669 mentioned may represent. At least £30,000 will be available for reducing the indebtedness of the city; for the Local Government Board would undoubtedly ordain that the money should be devoted to reducing the sums that have to be set aside every year in respect of the many municipal loans for sinking fund and interest. It is a complicated sum to work out how much the annual reduction would be; but we believe we should not be far wrong in placing it as equivalent to a rate of 2d. in the pound.

With regard to the street lighting, we hear the undertakers offer to reduce the price now being paid for the public arc lamps by one-fifth on the day they take over the concern, by another fifth on the day their preference shares pay 5 per cent., and another fifth on the day the ordinary shares pay 4 per cent. As the Chairman says these lamps are now paid for at the rate of 2½d. per unit, it is easy to reckon that, should the dividends stipulated be paid, the arc lamps will be supplied at 1d. per unit. In this event, there would be another big economy to the city, and a financial advantage to be thought of besides the 2d. rate less which would result from the money paid by the purchasers.

Last year £4389 was paid for the public lighting by electricity; and if this were reduced by two-thirds, the gain would be considerable. As regards private lighting, that would be reduced to 4d. per unit, instead of 5d. as at present. So far as we are able to judge at present, we should say that the Corporation would be doing the right thing if they closed with this excellent offer for disposing of the electric light works, provided always that the interests of the ratepayers are safeguarded, and that an undertaking is given that the cost of the illuminant for public and private lighting would not be raised.

We are further informed that the Syndicate will expend any sum up to £200,000 upon the rebuilding of the works in Dorchester Street, and in placing down the latest machinery which would be capable of supplying the tremendous output necessary for the whole of the county of Somerset; for it is their intention to make the concern one of colossal proportions. The Syndicate is a very wealthy one; and is willing to pay over to the city £100,000 on the day that the contract is signed, and the balance at any time appointed by the Corporation, *plus* 5 per cent. for interest. It may be stated that the principal officers at the works would have their positions secured on certain terms.

Are the prospects of the undertaking sufficiently rosy to warrant the mostly deeply inoculated municipal trader in the Council arguing for its retention when such an offer is to hand? Since the city acquired them, the net loss has been £2629, after giving the Corporation credit for the £886 they have in reserve, a source from which the deficit on last year's working of £318 had to be made good. But what did the Chairman of the Committee state at the last meeting of the Council when electric light matters were discussed—that they hoped to get through the present winter. "Muddle through" would perhaps be more appropriate, to use the term of an ex-Cabinet Minister. And then a big expenditure on new cables has to be faced. The old wires from Dorchester Street to Bladud Buildings must be replaced. He made that clear. Since then the Wells Road district has given ominous warning; and £20,000 would be a moderate estimate of the next loan that would have to be applied for, and applied for soon, if the light guaranteed the public and private consumers is to be supplied.

**Reduction in Price at Mansfield.**—The Mansfield Gas Committee have considered the question of the price charged for gas, and have decided to make a reduction of 2d. per 1000 cubic feet as from the beginning of next year. The rates will then be 2s. 4d., 2s. 6d., and 2s. 8d. per 1000 feet.

**Gas Fatality at Nottingham.**—Lucy Shaw, a widow, 67 years of age, was found by her landlady in an unconscious condition at a house in Nottingham; the tap of the gas-bracket being full on, but unlit. Death subsequently took place; and the Coroner's Jury found that the occurrence was an accident. The landlady said she did not think deceased was really capable of taking care of herself, as she was likely to do a thing and then forget all about it. She had been in an asylum.

## ELECTRIC LIGHTING AT PORT ELIZABETH.

### An Unsatisfactory Undertaking.

We learn from a copy of the "Cape Daily Telegraph" for the 18th ult., just to hand, that the Town Council of Port Elizabeth have been seriously considering the financial position of the municipal electric light undertaking. The discussion arose on a report presented by the Town Treasurer, in the course of which he said the Engineer (Mr. Pape) estimated the cost of completing the work at £5000, which would mean an amount of £16,433 overspent on account of the estimates, and of £5663 on account of the whole loan. In addition to this, it would be necessary to provide trading capital to the extent of at least £5000, either by means of a loan or by an authorized overdraft. The state of affairs will be best appreciated from the following remarks of Mr. Kemsley. He said the amount raised by loan for the purposes of the electrical installation was £100,000, and the cost of flotation was £5496; leaving in hand a net amount of £94,504. The Engineer's estimate of the cost of the scheme was £83,558; and they thought they would have available about £11,000, in order to provide for working account, as well as for any extensions that the Council might feel necessary. The position they found themselves in to-day was that the Engineer's estimate had been exceeded by £16,000, after making allowance for savings effected at the power-station on the original estimate, the decreased cost of mains, &c. The position they had to face was that the scheme had practically cost £100,000 because of the money laid out. £4000 of the loan had been spent on extensions which were not in the original estimate, as set forth in the Engineer's statement. In addition to this, £1465 had been expended on stock. Thus the extra charges on working, &c., amounted to £5400. They had to find the money to complete the scheme, and they had to decide whether they would do so out of their funds or go to the public. His personal feeling was that the amount was not sufficient for them to go to the public, if they could raise it in any other way. When they initiated the scheme, they made no provision for carrying it on when it was completed, because they thought there would be sufficient money left over for the purpose. Therefore they required an additional £5000 for stock and working capital, and also £5000 to complete the work.

There was a long discussion, which brought out some very unsatisfactory features in connection with the undertaking. The first had reference to the power-house. There is reason to suspect that the machinery is not what it ought to be. To what extent the boilers and the turbines are actually defective, and whether the defects are defects of construction, of erection, or of working, is not very clear; but certainly there appears to be something wrong somewhere. Another serious fact elicited was that the electric lighting is costing the Municipality about 1s. per unit, while they are selling at 9d. a unit; and those who had their premises installed were partly persuaded to do so under the impression that at no distant date the cost of lighting would be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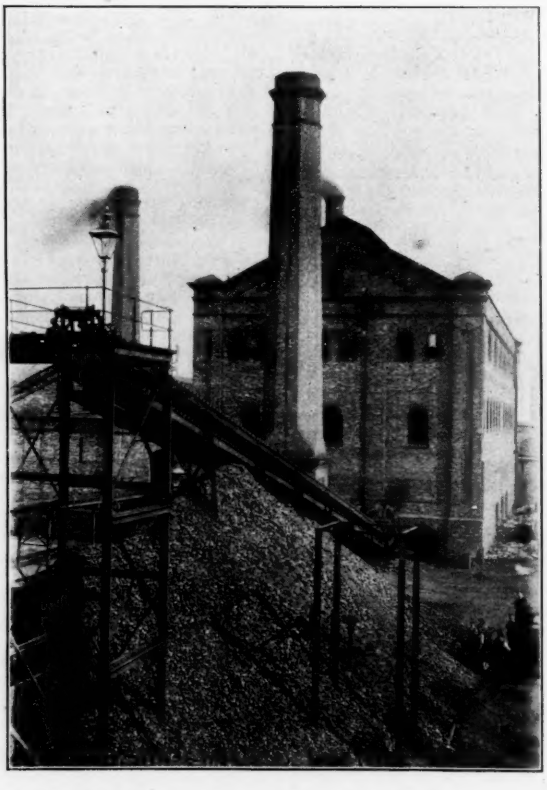

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reduced. Apparently there can be no hope of any reduction being made for some considerable time; and the Council may even have to face the problem of increasing their charges. Then the light in the streets is not giving satisfaction; for one speaker said the ratepayers wanted better light than was given by gas, and they were not getting it from the Nernst lamps. Eventually a resolution was passed to the effect that, to complete the scheme, the sums of £4000 extras not estimated and £1465 14s. 8d. on stock, &c., not chargeable to capital account, should be borrowed from the town loan fund, and repaid to the electric light account, to enable the Engineer to complete the scheme; and that a further sum of £10,000 be borrowed from the town loan fund as working capital.

Commenting upon the facts disclosed during the discussion, and upon the position of the undertaking, the paper from which the foregoing particulars have been taken says: "The revelations are to be deplored, because we have always maintained that the Council were unwise in not accepting an offer made by the Electric Tramway Company, some time ago, to act as contractors to the Municipality. The Company undertook to light the whole town, and supply electricity for private persons, as contractors to the Council. They would have been responsible for the laying down of the cables, and for making the connections, as well as for the machinery necessary; and they could have undertaken the work at a great advantage. They offered to sell current to the Municipality for street lighting at 4d. per unit, and for private house lighting at from 4d. to 7d., depending upon the annual consumption; and the Municipality could have retailed it to consumers at (say) 8d. or 9d.—thus making certain of a profit without running any risk whatever. But the offer was not favourably considered, and we are afraid it is now too late to go back upon it. The Port Elizabeth Municipality is not unique in finding out, when too late, that electric schemes are apt to prove very costly undertakings." We may add that the discovery must be rendered all the more unpalatable from the fact that the South African Lighting Association, supplying light at about one-tenth the cost of electricity, make a profit by it.

## BIRMINGHAM WELSH WATER LOANS.

### Better Terms for Repayment Wanted.

At last Tuesday's Meeting of the Birmingham City Council, a lengthy discussion took place with regard to the desirability of promoting a Bill in Parliament to sanction a postponement of the repayment of loans for the Welsh water scheme until the expiration of sixteen years from the date of each exercise of the borrowing powers.

In proposing that the Water Committee should be authorized to take the preliminary steps for the promotion of such a measure, Alderman Lawley Parker said the resolution was the outcome of wishes expressed by several members of the Council in May last that some means should be sought for reducing the charge on the rates. He wished to explain that he was to some extent mistaken when, in answer to a pressing question, he expressed the opinion that there was no reason to anticipate any further claim on the rates if the water-rents increased at the rate of 3 per cent. per annum. At that time the full materials were not at hand to enable him to go exhaustively into the very complicated matter, and therefore he had better not have expressed any opinion; but he was anxious to answer the question. He now thought that he took too sanguine a view, particularly in assuming an increase of water-rents of 3 per cent. The City Treasurer and the Secretary of the Water Department had since prepared tables on the basis of 2⅜ per cent. increase now, followed by 2½ per cent., and again by 2¾ per cent. increase later; and it was seen from these that in three years after the sinking fund came into charge under the 1892 Act—*i.e.*, commencing in 1912—there might be a period of a few years during which the demand on the rates would be heavier than at present. By the Act of 1902, power was given to defray interest or deficiency out of capital borrowed to the extent of £300,000—limited, however, to £60,000 in any one year. This £300,000, which would suffice to meet the deficiency for three years after the sinking fund began, would probably be exhausted by 1912, if no relief was obtained; while the growth of the water-rental on the less optimistic basis now taken would not by that time have reached a figure to cover the sinking fund charge. The proposal submitted was regarded by the Committee as the best means of guarding against any increase of existing charges on the rates; and they thought it was one that Parliament could be fairly asked to sanction. The grounds for making the application were: (1) That a large proportion of the capital expenditure on the scheme was in respect of work done to meet the needs of future generations; (2) the cost had greatly exceeded the parliamentary estimate, and had cast a burden on the rates which was not anticipated at the time the 1892 Act was obtained; (3) the whole of this burden fell on the ratepayers of the city, and the 270,000 water consumers living outside had equal benefits, but contributed nothing; (4) the works in the Elan Valley were of such a substantial character that it was considered they would last for centuries; (5) no extension of the sixty-years limit of the sinking fund was asked for; (6) £4,000,000, or two-thirds of the capital, had been raised by loans issued from eleven years down to seven years since, and so the sinking fund was suspended for those periods instead of the full sixteen years. If Parliament sanctioned this and all went well, the City Treasurer told them that the increased charge on the rates would not be needed, and that there might be a small reduction of existing charges, notwithstanding that provision was made to meet the charges for interest and sinking fund in laying a third pipe when it was assumed it would be required. This equalization of the sinking fund would throw a little more of the charge on the later years; but as during that time the charge on the rates would be extinguished by the increased income from water-rents, it was only fair that the ratepayers of that happy period should bear their share.

The motion having been seconded, Mr. Walthall said he thought the


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| Saltley Works, Birmingham | 2,000,000 | York | 750,000 | Gravesend | 300,000 |
| Colchester | 300,000 | Rochester | 500,000 | Pernambuco, Brazil | 125,000 |
| Birkenhead | 2,250,000 | Kingston, Ont. | 300,000 | Duluth, (Second Contract) | 300,000 |
| Devizes | 120,000 | Crystal Palace District | 2,000,000 | Leicester (Second Contract) | 1,000,000 |
| Saltley, Birmingham (Second Contract) | 2,000,000 | Duluth, Minn. | 300,000 | Newport (Second Contract) | 250,000 |
| Windsor St., Birmingham (Second Contract) | 2,000,000 | Caterham | 150,000 | Brockville | 250,000 |
| Halifax | 1,000,000 | Leicester | 2,000,000 | Toronto (Third Contract) | 750,000 |
| Toronto | 250,000 | Enschede, Holland | 150,000 | Montreal, Ont. (Second Con.) | 1,800,000 |
| Ottawa | 250,000 | Buenos Ayres (River Plate Co.) | 700,000 | Toronto (Fourth Contract) | 1,000,000 |
| Lindsay (Remodelled) | 125,000 | Burnley | 1,500,000 | Hamilton, Ont. | 400,000 |
| Montreal | 500,000 | Kingston-on-Thames | 1,750,000 | Rochester (Third Contract) | 1,600,000 |
| Toronto (2nd Cont., Remodelled) | 2,000,000 | Accrington | 500,000 | Leeds (Second Contract) | 900,000 |
| Belleville | 250,000 | Tonbridge | 300,000 | Buenos Ayres (Primitiva Co.) | 1,200,000 |
| Ottawa (Second Contract) | 250,000 | Stretford | 500,000 | Buenos Ayres (New Co.) | 1,200,000 |
| Brantford (Remodelled) | 200,000 | Oldbury | 300,000 | Christchurch, N.Z. | 300,000 |
| St. Catherines (Remodelled) | 250,000 | Todmorden | 500,000 | Rochdale | 1,600,000 |
| Kingston, Pa. | 125,000 | Saltley, Birmingham (Third Contract) | 2,000,000 | St. John's, Newfoundland | 250,000 |
| Peterborough, Ont. | 250,000 | York (Second Contract) | 750,000 | Brantford (Second Contract) | 400,000 |
| Wilkesbarre, Pa. | 750,000 | Rochester (Second Contract) | 500,000 | Smethwick (Second Contract) | 500,000 |
| St. Catherines (Second Cont.) | 250,000 | Newport (Mon.) | 250,000 | Pontypridd | 250,000 |
| Buffalo, N.Y. | 2,000,000 | Tokio, Japan | 1,000,000 | Montreal (Third Contract) | 1,800,000 |
| | | Newcastle-on-Tyne | 1,800,000 | Guelph, Ont. | 350,000 |
| | | Leeds | 1,800,000 | Buenos Ayres (River Plate Co.) Second Contract | 750,000 |
| | | | | Belgrano (River Plate Co.) | 500,000 |
| | | | | Quebec | 250,000 |

**And, in addition, COAL GAS PLANTS at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.**

Water Committee, in their proposals, had not extended the time sufficiently. They were entitled to the sympathy of the Council; but they had always been too sanguine. They should take one of two courses—either extend the period for deferring repayment from sixteen years to twenty-five years, or take the bull by the horns and apply for an extension of the period of the loans from sixty to a hundred years. He knew it would be said that this had never been done before; but surely Parliament would deal with the question of works like the Welsh water scheme in a special manner. It was absurd to say that such stupendous works were not the proper subject for a loan for a hundred years. Mr. Brooks said the Committee had raised the water-rents to practically the maximum allowed; and yet in 1903 there was a deficiency on the water accounts to the extent of £45,000, and again this year they had to face a further deficiency of £20,000. It was a very serious position for the ratepayers. There was no disguising the fact that they had arrived at a critical situation in regard to the water scheme. He entirely agreed with Alderman Lawley Parker that when they considered the magnitude of the work, it was only just and reasonable that the cost should be equitably spread over the present and future generations. Several other members spoke, among them being Mr. Keegan, who said "the Water Committee and the Council were guilty of a series of blunders unparalleled by any corporation in the kingdom"—a suggestion which was warmly repudiated by Mr. Hunt, a member of the Committee.

In replying to the discussion, Alderman Lawley Parker admitted that the Committee had from the first been too sanguine. Everybody had been too sanguine about the scheme, from the Engineers downwards. There were no two opinions as to the desirability of their going to Parliament for a scheme of relief; but it was suggested that something better could be done than the Water Committee were proposing. He was afraid there would be no prospect of their getting any longer period than the uniform sixteen years' suspension of the sinking fund payments from the date of borrowing; and he was quite certain that there would be no prospect of their getting a loan for a hundred years. It was no good going to Parliament to ask for more than they were likely to get. The Committee had thought over the matter very carefully; and they considered their proposition was reasonable, and one which would effect the object they had in view. This being so, it would be unwise to load the Bill with other conditions which might have the effect of throwing the whole thing out. The position was a very serious one; but they had a supply of water for which future generations would be thankful. They had reason to be grateful themselves; and nobody could realize what their position would have been if they had not obtained this supply. Unfortunately, they had to pay more for it than they expected; and they had to make the best they could of its having cost them more. The Committee did not complain of fair criticism; but such terms as "tremendous blunders" were painful to hear, and he believed that very few members of the Council would deem them proper.

The resolution was then passed.

## NOTES FROM SCOTLAND.

**From Our Own Correspondent.**

*Saturday.*

A chatty, useful gathering, but one of no great depth, is the most appropriate characteristic of the meeting of the Scottish Juniors in Edinburgh to-night. For a gentleman in his position, managing a gas undertaking with 600 consumers on the books, and an annual output of about 7 million cubic feet, Mr. A. Bishop, of Newtongrange, made a most creditable appearance, in the paper he read upon his experiences in dealing with consumers and their complaints. His experiences were not sensational, but very much of the every-day order. Yet his method of dealing with them, as they occur, is on a quite enlightened plane. It is agreeable to find that such is the case, because it brings out the fact that there is much talent behind the first line of gas managers. It also gives point to the remark made at a meeting of Scotch Gas Managers some years ago, that the manager of a small gas-works, having everything to do himself, is more likely to be a better all-round man than his colleagues in larger works. But, excellent though it was, Mr. Bishop might have improved upon his paper, in this respect—that, being in the position coveted by many, of having control of the gas from its manufacture to its consumption, he might have given some information regarding the number and nature of the complaints he receives. Those who yearn after the happy conditions under which he is supposed to live, could then, in some degree, have gauged the possibilities of the situation, could they succeed in attaining to their aspirations. It is probable, however, that what become formal complaints in other works do not, with him, get that length, because of his so continually coming into contact with consumers, in the fortnightly survey of meters, which is a peculiar feature of the management at Newtongrange. The duty is a laborious and an altogether impossible one in larger works; but it serves the good purpose of keeping short accounts, and also gives him the opportunity of putting right, on the spot, small matters which, with a longer absence, might become bigger. There were on the table several of the mechanical devices that were mentioned in the paper. These showed great ingenuity, and were examined with interest by the members at the close of the meeting. It will be observed from the report of the proceedings upon another page, that the Council put forward three questions for discussion at the meeting. These have every appearance of having been selected with care, as if the intention had been to enlist the attention of as wide a circle of the members as possible; one being upon a chemical and the others upon engineering subjects. If this were the intention, it was rewarded with success, in the number of members attending, and in the number of new members who took part in the discussions. This is a feature which should be studied in the preparation of any further series of questions. It is an excellent way of bringing the members out, because there are many who might have something to say upon a point presented to them, who would not care

*The "Wizard" Slot Gas Fire*

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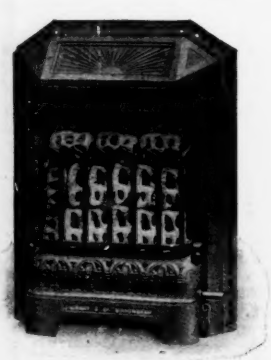

No. 7091.

The
**"JUNIOR"**
**Slot Gas Fire.**

1.—Patent Removable Brick and Burner.
2.—Shallow Fire-Front.
3.—Patent Gas Adjuster.
4.—Patent Air Adjuster.

Width of Fire . . **8 in.**

Gives a good Bright Fire with Gas consumption of but 12 feet per hour.

Height . . . 16½ in.
Width . . . . 12¾ in.

*Black Enamelled* . **13/6.**

JOHN WRIGHT & CO.,
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to read a paper upon it; and short, pointed communications are always preferable to long ones.

The Corporation of Dundee have published notice of their intention to apply for a Provisional Order of an omnibus nature, under the Private Legislation Procedure (Scotland) Act of 1899. Among the powers sought are authority to provide for the lighting of common stairs and courts with gas or other illuminant, and to light and extinguish the lamps, and to assess the community therefor—one half upon owners, and the other half upon occupiers. There is also a provision for the inspection of gas-fittings before use, and for the prohibition of their use if found to be insufficient in size, material, strength, construction, or workmanship, or if the method of laying would be likely to allow of the escape of gas. At present, landlords provide the gas-fittings, and are responsible for the cost of lighting, which they are empowered to recover from their tenants. The Gas Committee had the terms of the Provisional Order before them on Thursday. It was remarked that the powers asked were in line with those which the Corporation of Glasgow are seeking, and which have been in force in Edinburgh for some years. In a report upon the subject made by Mr. A. Yuill, the Gas Engineer, it was stated that if the lights were to be extinguished at 10 o'clock p.m. the annual charge upon the rates would be £4372—equal to an assessment of 1·33d. in the pound; if they were to be extinguished at 11 p.m. (which was the hour favoured by members of the Committee), the charge would be £4852—equal to 1·36d.; and if they were to be extinguished at the same hour in the morning as the street-lamps, the charge would be £7963—equal to 2·23d. The proposal is to take power to assess to a maximum of 4d. in the pound. At the Committee meeting, Mr. Ballingall protested against the proposal, which, in his opinion, would be an inequitable tax upon owners and occupiers of offices, shops, industrial establishments, and the like. To-day the "Dundee Advertiser" announces that the proposal of the Gas Committee, if it should be adopted by the Town Council (which it has not yet been), is likely to be opposed. A combination of the property interest, it is stated, has been formed for the purpose. With the view of raising the nesessary money, a circular was recently issued by the House Factors and Landlords' Association requesting subscriptions to a guarantee fund. The view of the Association was that £250 would be sufficient; but it is learned that about £1000 has been subscribed, and one gentleman keenly interested in promoting the opposition says that, if necessary, that amount could, without difficulty, be doubled.

The "Dundee Advertiser" to-day returns to the subject of the gas supply in the city, in an article in which it is stated: "Complaints regarding the quality of Dundee gas are spreading, and it is about time the members of the Gas Committee were bestirring themselves and making an endeavour to put matters right. The grumbling is not confined to one particular district, but is general; and not a few tenants have, while experimenting to improve the lighting of their rooms, spent considerable sums of money without much appreciable improvement. In several cases, larger and more expensive incandescent burners and mantles have been installed, while the ordinary upright lights have in one or two houses been thrown out and the inverted system introduced. A theory which is being persistently ventilated and believed in by men who have knowledge of the subject is that, with the view of enriching the gas and increasing the illuminating power, certain materials are being used which are being condensed and deposited in the pipes. Serious enough as it may be if the pipes in the streets belonging to the Corporation become choked, it is a matter of greater concern to house proprietors. It is a comparatively easy, though costly, operation to open up the streets to get at the pipes; but in the case of pipes inside a house, and as to which the Corporation assume no responsibility, the cleaning-out operation would be attended with great difficulty and expense to the proprietor, not to speak of inconvenience and discomfort to the tenant. The matter is becoming so serious that the Gas Committee should call for a report regarding the matter from the Gas Manager, and if it disclosed no fault at the gas-works, it would at least have the effect of satisfying the public mind."

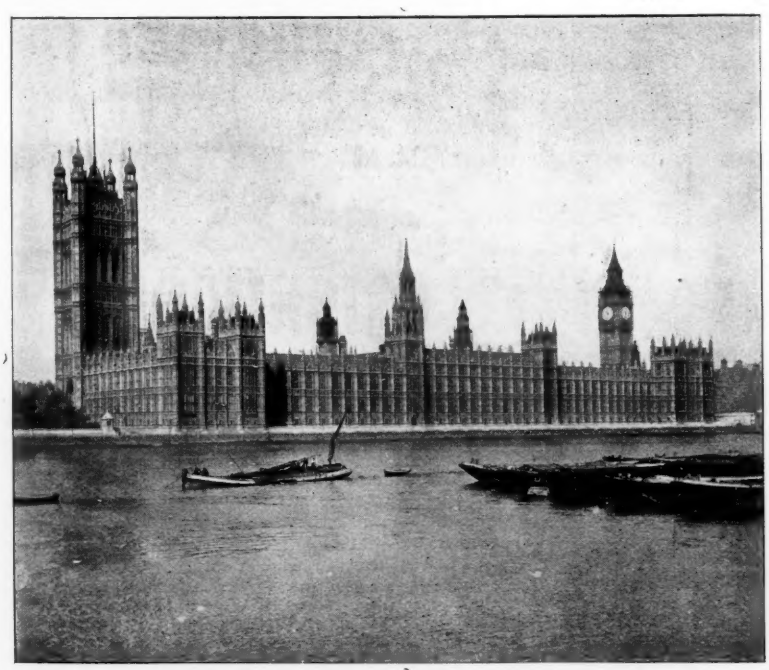
In the Kilmarnock Town Council on Wednesday, Mr. Climie, when the accounts were presented, called attention to items of expenditure for gas-meters and gas-stoves, and asked the Convener of the Gas Committee if he would be prepared to take back those items for consideration as to whether they should not be charged to capital, and their cost spread over a number of years, instead of being charged to revenue. Mr. R. Muir, the Convener of the Committee, said he had no objection to take the matter back; but he did not see that it would serve any good purpose, because it had always been the custom that this expense should be charged against revenue. So far as he knew, it was the custom in other places to charge expenditure of this kind against revenue; but if it were going to satisfy the Town Council in any way, he would be glad to take the matter back and have it discussed, and report. This was accordingly agreed to.

The question of the adoption of the Burghs Gas Supply (Scotland) Acts in Dunblane was settled yesterday by a poll of the ratepayers. There are 500 electors on the roll. The vote was: For, 51; against, 130. There was thus a majority against the proposal, on this very small poll, of 79. The Acts are not adopted, the result of which is to drop a pet scheme of Provost Murray.

Lord Provost Cuthbert, of Perth, has not long held the position of Convener of the Gas Committee, to which I mentioned last week that he had been reappointed by the Council. His Lordship was appointed to the post a year ago, when there were onerous duties in view. But in his office of Lord Provost he has ordinarily sufficient duties to occupy his time. Accordingly, at a meeting of the Town Council on Monday, Councillor Hamilton was appointed as Gas Convener. The Lord Provost was also nominated; but he expressed a desire not to be elected. On a division, the votes were equal; and he gave his casting vote in favour of Mr. Hamilton.

I observe that this week the following have been reappointed Gas Conveners: Bailie T. Stewart, at Dunfermline; Bailie M'Namee, at Wishaw; and Councillor Scott, at Denny.


# RADIATOR PICTURES, No. 5.



THE HOUSES OF PARLIAMENT.

A few of the Buildings in which WRIGHT'S well-known

**"ST. ANDREW"**

**GAS-HEATED STEAM RADIATORS**

are installed:

**The Houses of Parliament.**

**Corn Exchange, Newport.**

**Hippodrome, Southampton.**

**Royalty Theatre, London.**

**Wrights The Radiator People.**

## CURRENT SALES OF GAS PRODUCTS.

### Week ending Nov. 17.

In the London market prices have been steady. Ninety per cent. benzol has been in good demand, and it is stated that 1s. 1d. net, casks free, has been paid for prompt delivery. Ordinary London creosote continues very strong, and 2⅜d. net per gallon is now readily paid, and rather more is being asked. Crude carbolic remains without change. The recent decline in pitch has brought in much business, and makers are once more becoming firmer in their ideas. Sulphate of ammonia is perhaps a little easier; but £12 10s., Beckton terms, is still asked for prompt, while a premium is required for the spring.

LIVERPOOL, *Nov.* 17.

**Sulphate of Ammonia.**

The market has again been very quiet, and makers have had to submit to a decline in prices. There has been a fair amount of inquiry, but it has not led to much actual business; buyers being inclined to wait for a further decline, in which they have been encouraged by a certain amount of reselling. The closing quotations are £12 2s. 6d. per ton f.o.b. Hull, £12 5s. per ton f.o.b. Liverpool, and £12 7s. 6d. per ton f.o.b. Leith. In the forward position there is nothing special to report, for, while buyers are endeavouring to get in at but a slight premium on spot prices, the large makers, the bulk of whose output up to June is already sold, are not concerned to make further sales unless at previous prices. Any business which has been placed has therefore been taken speculatively.

**Nitrate of Soda.**

This article remains quiet at from 11s. 6d. to 12s. 3d. per cwt., according to quality.

LONDON, *Nov.* 17.

**Tar Products.**

There has been little alteration in the markets during the past week; but the demand for refined products continues good. Pitch remains quiet; but there are one or two large orders in the market for the East which may result in an improvement in the position. Several manufacturers appear anxious to sell for prompt delivery, and 27s. would probably be accepted at the principal ports on the east coast; while for January-June next year manufacturers are quite willing to accept 28s. In Manchester, 26s. 6d. has again been done for delivery to the end of the year; and 27s. 6d. in Liverpool. There is an absence of demand from South Wales and the Continent, though one or two sales are reported to have taken place at very low prices. Creosote remains very firm. Some quantity of London oil was sold second-hand at under 2½d.; but the manufacturers ask over this, and are fairly well sold. In the Midlands, makers are asking 2d., which price may also be considered to be ruling in the North, though one or two distillers would accept less. Carbolic acid still remains unchanged. It is reported that a Continental consumer has refused an offer of 60's on the east coast at 1s. 8⅜d. all over next year. In crystals, some contracts are reported to have been fixed at the market quotations. No business of importance is reported in toluol, which, however, is still very firm, as makers are well sold, and not inclined to place further quantities except at high prices. The demand for benzol, 90 per cent., is very good, especially for prompt delivery, for which high prices are reported to have been paid in London; 50-90 per cent. is steady. Prices are unchanged; and makers are not anxious to sell. Solvent naphtha is scarce, and prompt London qualities command good prices. It is reported that 1s. 4d. has been paid for prompt delivery for a small quantity, while 1s. 3d. is quoted over next year.

The average values during the week were: Tar, 16s. to 20s. Pitch, London, 28s. to 28s. 6d.; east coast, 27s. to 27s. 6d.; west coast, 26s. 6d. to 27s. 6d. Benzol, 90 per cent., 11½d. to 1s.; 50-90 per cent., 11½d. to 1s. Toluol, 1s. 1½d. to 1s. 2d. Crude naphtha, 4⅜d. to 5⅛d.; solvent naphtha, 1s. 2½d. to 1s. 3½d.; heavy naphtha, 1s. 2d. to 1s. 4d. Creosote, London, 2 1/16d. to 2¼d.; North, 1⅝d. to 2d. Heavy oils, 2⅜d. to 2½d. Carbolic acid, 60 per cent., 1s. 9d. to 1s. 9½d. Naphthalene, £4 to £9; salts, 32s. 6d. to 35s. Anthracene, "A" quality, 1½d. to 1⅝d.

**Sulphate of Ammonia.**

Markets are quiet, and there is not much business doing; November requirements being evidently now completely filled. London values are unchanged. The principal Gas Companies quote £12 11s. 3d. for November-December, and £12 15s. forward; but other makers are willing to sell at £12 5s. on Beckton terms. In Leith, there is little business doing. Makers are well sold, and the nominal price remains £12 10s.; but the value is probably not over £12 7s. 6d. In Hull, outside makes are reported to have been sold at £12 2s. 6d. to £12 3s. 9d.; but the latter price has been refused for a fine quality for November delivery. In Liverpool, business is reported at £12 5s. to £12 6s. 3d. In all cases very much higher prices are asked for forward delivery.

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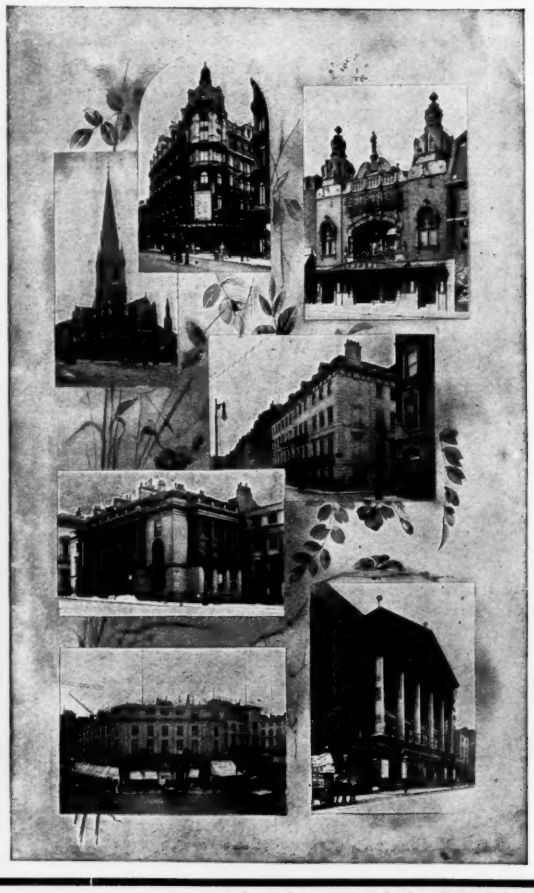
Last Sunday, the stepson of the landlord of a Southampton public-house and a lodger were found dead in bed. They retired to rest on Saturday night; and no sound being heard on the following morning, the door was opened. There was an escape of gas; and an investigation showed that the tap had not been properly turned off. There was no ventilation in the room; and both men had evidently died in their sleep.

A water-main burst at the east end of Drury Street, in the centre of the City of Glasgow, on Monday morning. The rush of the escaping water tore up a large patch of roadway. West Nile Street, Mitchell Street, and part of Gordon Street were flooded, a large number of basement premises being invaded, and considerable damage done to goods. The workmen of the Water Department repaired the damaged main in the course of the day.



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## COAL TRADE REPORTS.

**Lancashire Coal Trade.**

There is no change in the Lancashire coal trade, except betterment in all sections. Full current rates are secured on all new orders; and prices generally have a hardening tendency. Coal for vessels on the Ship Canal, and for export, is in good demand. There is a firm inquiry for furnace coke. The questions of the reconstruction of the Coal Conciliation Board and the application of the miners for a 5 per cent. increase in wages are yet in abeyance; the conference in London last Tuesday being adjourned till December. The operative miners are also seeking to secure the raising of the minimum rate of wages from 35 to 40 per cent. above the 1888 basis. The quotations at the Lancashire pits are: Best house coal 13s. 6d. to 14s. 6d. per ton, secondary 12s. 6d. to 13s. 6d., common 9s. to 10s., burgy 7s. 6d. to 8s. 6d., best slack 6s. 9d. to 7s. 6d, medium 6s. 6d. to 7s., common 5s. 9d. to 6s. 6d., shipping coal 7s. 6d. to 10s. 6d.

**Northern Coal Trade.**

There is a rather better request for coal; but the increased output of late makes the supplies ample, and prices are easy for some kinds. In steam coals, best Northumbrians are 11s. to 11s. 3d. per ton f.o.b., second-class steams about 10s., and steam smalls 7s. to 8s. The collieries are working fairly full for this season—which is usually a dull one—but there is no pressure in the demand. In the gas coal trade, the most striking feature is the very full deliveries that are being made on the long contracts, so that there is less coal free for sale. The price of Durham gas coals varies from about 10s. to 11s. 3d. per ton, generally f.o.b.; but there are one or two of the best collieries well placed with contracts, and able to ask for and command higher prices. One or two contracts for gas coal are now in negotiation; but they are not for very large quantities, and thus will not affect the general values. Coke is firm, and gas coke maintains its price; while some of the companies are trying to foster the sale for domestic use. Good gas coke varies from about 13s. to 14s. per ton f.o.b. for export.

**Scotch Coal Trade.**

Trade has been well maintained, and prices keep up. Outputs at all collieries are being fully taken up. The quotations given are: Ell 9s. 6d. to 10s. 9d. per ton f.o.b. Glasgow, splint 10s. 6d. to 11s., and steam 9s. 6d. to 9s. 9d. The shipments for the week amounted to 283,285 tons—a decrease of 10,685 tons upon the preceding week, but an increase of 32,729 tons upon the same week of last year. For the year to date, the total shipments have been 12,018,417 tons—an increase of 1,296,001 tons upon the corresponding period of 1905.

The Heywood Water Board have at last opened their doors to the Press; and we now know that, including £24,299 paid for land and interest, but excluding £6580 paid for plant, the works at the Ashwood Moor reservoir cost £176,786.

## Appreciation at Longton.

Speaking at a complimentary banquet at which he was entertained last Wednesday, the retiring Mayor of Longton (Mr. A. Bailey Jones, J.P.) reviewed at length the work of the various Committees during his year of office; and he spoke in high terms of the management of the Gas and Electric Lighting Department. He said that twelve months ago the price of gas was reduced to 3s. 1d. per 1000 cubic feet, less 5 per cent., and for gas-engines to 2s. 6d.; while in March a further reduction was made for gas used for engines. In April the Gas Engineer (Mr. W. Langford) was empowered to fit up an experimental kiln to test colour-firing by gas. This had been done with promising results, and was being continued with kilns of larger size, more suitable for local manufactures. The quantity of gas sold was in excess of last year; while the general returns were very satisfactory. During this year, £2500 was handed over in relief of the rates, making a total of £60,397 contributed in this way since the gas-works were acquired.

**A Blow at the Standard Oil Company.**—Mr. Moody, the United States Attorney-General, acting through the Resident District Attorney, has instituted proceedings against the Standard Oil Company under the Sherman Anti-Trust Act, by filing before the Circuit Court at St. Louis a petition in equity against the Company and its seventy constituent corporations and partnerships, and seven individual defendants. The petition asks that the combination shall be declared unlawful, and shall in future be enjoined from entering into any contract or combination for the restraint of trade. The correspondent of "The Times" in New York says the action of the President in beginning war against the Company meets with popular approval, and the belief is gaining ground that a practical and serious attempt is being made to bring to account the various parties concerned.

**New York Water Supply.**—The Board of Water Supply of New York City are about to let the first contract for part of the new system of water-works to supply the city with 500 million gallons of water daily from the Catskill Mountains, at a cost of £32,000,000. The principal features of the entire system are: The Ashokan reservoir, a very large impounding reservoir, about 12 miles long, of more than 100,000 million gallons capacity, in the valley of Esopus Creek, about 14 miles north-west of Kingston; an aqueduct approximately 82 miles long; a large storage reservoir, to be known as the Kensico reservoir, near White Plains; filtration plant near Scarsdale; a terminal distributing reservoir, to be known as Hill View reservoir, in Yonkers; and conduits from the Hill View reservoir to the various boroughs of the city. The Catskill aqueduct will extend from the Ashokan to the Kensico reservoir, and thence to the Hill View reservoir; and it will comprise a number of stretches of plain concrete conduit, 17 feet high by 17 ft. 6 in. wide inside, a number of tunnels on the hydraulic gradient, several syphons across shallow valleys, to be made of reinforced concrete or steel pipes, and others, crossing deep valleys and the Hudson River, which will be masonry lined tunnels designed to withstand great pressure.

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## The "Financial News" on a Proposed Debenture Issue.

The following remarks on a proposed issue of debentures by the Water-Works, Lighting, and Power Investment Corporation, Limited, appeared in the "Financial News" last Saturday: "A prospectus of the Water-Works, Lighting, and Power Investment Corporation, Limited, notifying the issue of £10,000 of 6 per cent. first mortgage debentures, has been widely circulated during the past few days. The names of the Directors of the Company are not given. The price of issue is £95 per cent.; and the debentures are redeemable at £103 on July 1, 1919, unless previously repaid. The Company was registered during the present year with a capital of £2000, and would appear, from the figures issued, to have done remarkably well, as the present assets are put down as £15,425 1s. 9d. There is, however, a certain amount of vagueness with regard to the character of these assets. Thus, the amount owing to the Corporation on 'engineering contracts (in progress), together with book debts and loans,' which, it is stated, will 'in due course be realized,' is put down at £9018 1s. 9d. This amount, we need scarcely point out, appears to be dependent on the fulfilment of the contracts. The Company's investments in water, gas, electric lighting, and engineering companies are valued at £2257; but no details of these investments are vouchsafed. Stock in hand is valued at £4000, and an item of £150 for sundries figures in the list. The founders of the Company have already advanced £2000 in temporary loans; and it is arranged that this amount should be refunded to them out of the present issue of debentures. Beyond remarking that the amount of debentures, as compared with the ordinary share capital, is somewhat out of proportion, and that the Company's assets are to a great extent problematical, the discussion need not be prolonged."

## Aspatria, Silloth, and District Joint Water Board.

There has for some time been a dispute outstanding between the Wigton Rural District Council and the Holme Cultram Urban District Council, and the Aspatria, Silloth, and District Joint Water Board. The question was whether the Water Board or the parishes (through the District Councils) should pay for the cost of service-mains in the localities scheduled in the Water Boards' Act of 1901, but outside the contributory districts—such localities having paid nothing whatever of the initial cost of £45,000. As a test case, the Water Board and the Holme Cultram Council agreed to accept the Local Government Board's dicision so far as related to the water supply of the village of Skinburness, in the scheduled area. After due consideration, the Local Government Board have come to the following conclusion: That it is obligatory upon the Aspatria, Silloth, and District Joint Water Board to provide a supply of water proper and sufficient for public and private purposes in the part of Holme Cultram not included in Silloth. That the terms for such supply in bulk should be regulated by agreement under section 58 of the Aspatria, Silloth, and District Water Act, 1901. That the execution of the works for the distribution of the supply will devolve upon the Holme Cultram Urban District Council; and that they must provide for the cost, presumably by a division of the district under section 211 (4) of the Public Health Act, 1875. That the position of the Urban District Council, if they act upon these conclusions, will be that of a local authority with a water undertaking under the Public Health Act, 1875, in respect of the part of Holme Cultram. This decision is, of course, in favour of the Water Board, as it frees them from any liability with respect to the laying of service-mains in the scheduled parishes, and upholds the position they have taken.

## Fatal Leakage from a Gas-Service at Bradford.

A leakage from a gas-service pipe caused two fatalities at Bradford last week. As an old couple living in one of the poorer parts of the city had not been seen since Sunday night, a relative last Tuesday morning broke a window, and so gained access to the house. He found on the floor, immediately behind the entrance door, the dead body of the man—who was a tinworker, named Gill, 62 years of age—and beside him the dead body of a favourite cat. Mrs. Gill was on a bed upstairs. She was unconscious, and was removed to the Infirmary in a dangerous condition. The old man, it is thought, had been dead for something like twelve hours. He was only partially dressed; and he held in his hand a screw-driver, with which he had apparently endeavoured to open the door—the theory being that he was unable to find the key, and had taken the screw-driver in order to force open the door. It was probably while thus engaged that he was overcome. Mrs. Gill was saved to some extent by the fact that the bed-room door was closed; and thus the gas had only partially filled the room. The Gills did not use gas; and when the police made investigations, they found that there was a hole in a service-pipe which runs through the cellar. Corporation workmen afterwards removed the pipe, and discovered that at the point where the leakage occurred the metal was badly corroded. Mrs. Gill died subsequently; and at the inquest on the two bodies, the Jury found that death was caused by asphyxiation, and added a rider to the effect that the Corporation authorities should make a periodical examination of the service-pipes in houses where there was no meter. During the inquest, one of the witnesses admitted that it would be possible, if anyone had been hammering in the next cellar, that they might have caused the pipe to leak; but he added that it looked more like a case of the pipe being worn. The Coroner, in reviewing the evidence, said there had not been to his knowledge such an occurrence during the past thirty years. The pipe was under the care of the Corporation authorities; and he thought that the officials, knowing a thing like this might happen, should give some instruction to the inspectors to keep an eye on the pipes in future. Mr. Fleming, on behalf of the Gas Committee, expressed regret at the occurrence, and also sympathy with the son of the deceased couple, who was on his way home from South Africa. With regard to the recommendation of the Jury, he said that already the inspectors had instructions to examine the service-pipes.


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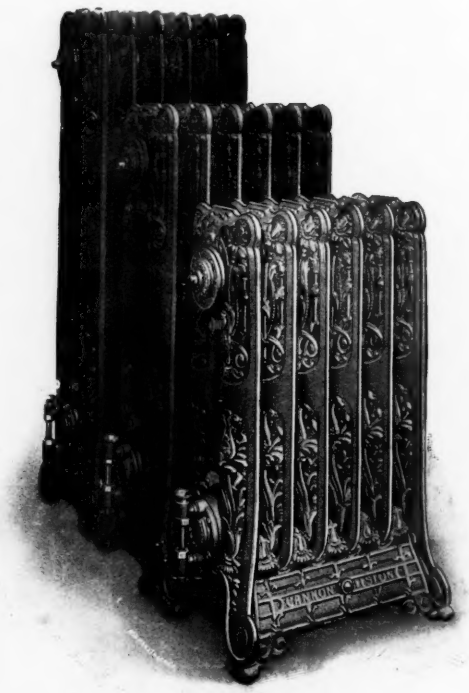


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*and Box No. 4 (G.P.O.) Dunedin.*

## Devonport Water Supply.

It was decided by the Devonport Town Council yesterday week to promote a Bill in the next session of Parliament for the extension and improvement of the water-works. The undertaking has been acquired by the Corporation this year from the Devonport Water Company. Four years ago, the Company sought parliamentary powers for the extension of the works, but were opposed by the Corporation, who bought out the Company on arbitration terms. It is estimated that the new works now to be carried out will cost £80,000. Of this sum, £39,000 is put down as the cost of land and easements and for the construction of a new reservoir; £11,000 for the blocking, or lining with stone, portions of the existing leat; and £30,000 for general water-works purposes, including the provision of new trunk and other mains. An important part of the scheme is the substitution of a main for the existing open leat in the latter portion of its course; while the blocking of the remaining portion is calculated to reduce the loss due to leakage. The proposed new reservoir and filter-bed are urgently needed; the present storage being only equal to eight days' maximum supply. It was moved at the Council meeting to omit this portion of the scheme, with a view to limiting the cost; but it was pointed out that an increased quantity of water would be of little use without means of storing it; and the recommendation of the Water Committee was carried by a large majority. One of the clauses of the Bill provides a scale of charges for water for houses whose gross estimated rental exceeds £80 a year. The present maximum is reached with houses at that rental; and all above it pay the same amount as houses of £80. Under the new scale, there will be a progressive increase in the charge for water for houses up to £150 rental, which will pay £5 per annum—all above £150 paying £5 5s. a year.

**Fatal Accident at the Widnes Gas-Works.**—While working on the top of a gasholder which is being erected at the Widnes Gas-Works, a riveter named George Brought fell through a hole, a distance of 20 feet. He was unconscious when picked up and taken to the Accident Hospital; and on the arrival of medical aid, life was pronounced to be extinct.

**Professor Smithells on "Flame."**—An interesting lecture upon "Flame" was given last Thursday evening by Professor Smithells before the members of the Bradford Philosophical Society. The lecturer demonstrated the two methods by which gas may be made to glow—viz., electrical stimulus and chemical action. He dealt almost wholly with the latter process, and traced the growth of the incandescent mantle, the manufacture of which he described by means of experiment. He told his audience that this was our most economical illuminant, seeing that from 1 cubic foot of gas it was possible with it to get four or five times the efficiency of light derivable from an ordinary flame.

**Further Powers for the Newquay Water Company.**—The Newquay and District Water Company will, it is said, promote a Bill in the next session to confer upon them additional powers. It is understood that the Company will seek to include the Pentire Estate within their limits of supply, and ask for authority to increase their capital. The Newquay Urban District Council proposed to purchase the undertaking, and would have promoted a Bill in the last session for this and other purposes; but it was thrown out by the ratepayers. The water supply in Newquay during the past season has been ample for all purposes; and the reports of the Council's Analyst have proved that the high quality has been fully maintained.

**Manhole Explosion at Southampton.**—Last Friday morning, considerable alarm (but, fortunately, no personal injury) was caused by a manhole explosion at Southampton. The iron manhole cover was hurled high into the air; and this was followed by a considerable volume of smoke. The actual explosion is thought to have been caused by the ignition of a match in a cellar; but the affair has by no means been cleared up. The officials of the Gas Company investigated the matter, but could locate no escape of gas; while the Borough Electrical Engineer states that the explosion could not possibly be traced to the electricity service, as the cable at the spot where it occurred is, and has been for some little time past, quite dead, and under repair.

**Borrowing Powers at Shipley.**—An inquiry was held last week by Mr. F. J. Willis into an application by the Shipley Urban District Council for a Provisional Order to amend a Local Act so as to enable the Council to borrow, with the consent of the Local Government Board, additional sums of money for the purposes of the gas undertaking. The Clerk to the Council (Mr. Lindow) said the inquiry was of a purely formal character, as the question of the £6000 excess expenditure in extensions and alterations sanctioned by the Act under which the gas-works were purchased had already been inquired into. The Local Government Board had held, however, that they could not grant the borrowing powers for excess expenditure under the Act referred to; and hence the application for the Provisional Order. The Council asked that this Order should enable them to apply to the Local Government Board for further borrowing powers if necessary.

**A Gas-Engine as a Bird Trap.**—The "Nottingham Express" says that a rather strange solution to a puzzling difficulty was found a few days ago at Sutton-in-Ashfield, where a small gas-engine, built by Messrs. Manlove, Alliott, and Co., Limited, of Nottingham, and supplied to the Council, had begun to show signs of working in an unsatisfactory manner. One of Messrs. Manlove's fitters was sent from Nottingham; and on disconnecting the air suction-pipe, a small wild bird was found lodged in such a position that one of the wings had got under the gas-valve, preventing it closing tightly. Apparently the grid at the mouth of the suction-pipe had become displaced, and the bird—evidently of an investigating turn of mind—had got too close to the suction-pipe, and been drawn in by the inrush of air, carried round the bend, and through the length of pipe till it lodged in the restricted area at the valve. Of course, the poor bird was dead when it was discovered. Instances have been known where experts have been called upon to make long journeys in order to investigate the reasons why gas-engines will not start, and the trouble has turned out to be that the gas has not been turned on at the meter; but the above is a still more unusual cause for a gas-engine not working satisfactorily.

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**New Issues of Gas and Water Capital.**—There was no evidence of the existence of a high bank-rate or of the present general unsettled state of the investment markets at the sale conducted by Mr. Alfred Richards at the Mart, Tokenhouse Yard, E.C., on Tuesday last, for the room was filled to overflowing with keen competitors for the new issues of gas and water capital he had to offer by order of Directors. In conjunction with Mr. W. Ashmole, of Ilford, he invited bids for £10,000 of ordinary "C" stock of the Ilford Gas Company, ranking for a standard dividend of 5 per cent., subject to the sliding-scale (all dividends on similar stock of the Company having been paid at the rate of 6 per cent. per annum); and it was all sold at from £120 to £121 10s. per £100. He then placed a new issue of 1500 ordinary £10 shares (5 per cent. maximum dividend) in the Southend Water Company, at from £10 5s. to £10 17s. 6d. each; and he afterwards sold a parcel of £1 ordinary shares in the Hungerford Gas Company, Limited, at par.

**The Richmond "Tubal" Greenhouse Heater.**—In connection with a show of flowers at the gardens of the Royal Botanic Society of London, the "Morning Post" last week made the following reference to the "Tubal" conservatory heater of the Richmond Gas Stove and Meter Company, Limited, which was described on p. 24 of the "JOURNAL" for the 2nd ult.: "The distinctive character of this apparatus warrants some reference; for there is no problem from the amateur point of view—especially the suburban amateur standpoint—more needing solution than the provision of a clean, inexpensive, and certain method of heating small glasshouses. The apparatus gives the flow and return in one pipe of ordinary hot-water diameter. The heat is provided by gas. The use of gas and oil for this purpose, more particularly when the stove is inside the house, has not as a general rule proved either economical or satisfactory; but the 'Tubal' heater appears to overcome the fume difficulty, and likewise it furnishes sufficient heat on a given consumption of gas to appear to justify the claim of being as cheap as, if not cheaper than, fire fuel. At the same time, it disposes of the trouble which amateurs frequently have with regard to smoke, and avoids the trials and worries of stoking." We learn that the Society's Certificate of Merit has been awarded to the apparatus.

**Proposed Gas-Works at Brockenhurst.**—At a meeting of the Brockenhurst Parish Council last Wednesday, a letter was read from Messrs. Baker and Co., of Westminster, stating that arrangements had been made for the acquisition of a site for the proposed gas-works; and it was intended to commence the construction of the works as soon as the negotiations were completed. The Council were asked for their support; and in view of the opposition to the scheme in 1905, when a petition was lodged against the Bill, the promoters said they were prepared to hold a public meeting to explain the scheme. It was agreed that this would be advisable.

**Two Light Failures at Concerts.**—By a curious coincidence, there were failures of light at two concerts last Tuesday. At the Portman Rooms, London, in the afternoon, during the singing, by Miss Louise Douste, of a song in the course of Miss Maude Valérie White's concert, the electric light suddenly failed, and the hall was plunged into darkness. The vocalist, however, never faltered; and Miss White, who was accompanying her on the pianoforte, was equally courageous. The two ladies not only managed to finish the song, but rendered another without faltering. At the close they were greeted with enthusiastic applause. In the evening, when a large audience was attending a concert in the Town Hall, Buckingham, in connection with the local Chrysanthemum Society's show, the hall was plunged into darkness by the sudden failure of the gas. A vocalist from London, who was singing at the time, prevailed upon the audience to remain quiet; and they were entertained by a gramophone until the light was restored. The accident was caused through a shortness of water in the meter, and a slight accumulation of naphthalene. As in many other cases, the meter was fixed in a small pit in a most inaccessible place.

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Owing to the breaking of one of the mains, the gas supply of Risca and Crosskeys failed on Friday night, and the district was plunged in darkness. On the previous day, the Council's motion to engage an expert to inquire into the undertaking of the Western Valleys Water and Gas Company, with a view to purchase by the Council, was rejected by a huge majority.

## WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

### Situations Vacant.

MANAGER. Gas and Water Works. Rhymney and Aber Valleys Gas and Water Company.
SECRETARY AND MANAGER. Aberdare Gas Company. Applications by Nov. 29.
CHARGE of Mainlaying, &c. (South America). "R.A." c/o Vickers, London.
FITTERS TO ACT AS AGENTS. Nuneaton Gas Company.
OUTSIDE FOREMAN. Portsea Island Gas-Fittings Company.

### Situations Wanted.

ASSISTANT TO SECRETARY. No. 4676.
RESIDUALS AND GENERAL CLERK, COLLECTOR, &c. 4678.

### Testing Meter Indices. No. 4668.

### Plant, Books, &c., for Sale.

EXHAUSTER AND ENGINE. Redditch Gas-Works.
"JOURNAL" VOLUMES. Winstanley Company.
PURIFIERS, GOVERNOR, STATION METER, EXHAUSTER, WASHER, &c. Berkhampstead Gas-Works.
STATION METER, &c. Farnham Gas-Works.

### Book Wanted.

"HARTLEY'S GAS MEASUREMENT." Shaw, Lambeth.

### Stocks and Shares.

BARKING GAS COMPANY. Nov. 27.
HARROW AND STANMORE GAS COMPANY. Nov. 27.
LEA BRIDGE GAS COMPANY. Dec. 11.
REDHILL GAS COMPANY. Dec. 4.
SOUTH ESSEX WATER COMPANY. Nov. 27.

### TENDERS FOR

### Pipes, &c.

ABERAVON GAS DEPARTMENT. Tenders by Dec. 1.

### Tar.

SHOTLEY BRIDGE AND CONSETT GAS COMPANY. Tenders by Dec. 11.

## GAS COMPANIES' STOCK AND SHARE LIST.

**Referred to on p. 514.**

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | £ s. d. |
| 590,000 | 10 | Oct. 12 | 10½ | Alliance & Dublin 10 p.c. | 20—21 | .. | 5 0 0 |
| 245,112 | 10 | ,, | 7½ | Do. 7 p.c. | 14—15 | .. | 5 0 0 |
| 200,000 | 5 | Nov. 14 | 7 | Bombay, Ltd. | 6½—7* | .. | 5 0 0 |
| 40,000 | 5 | ,, | 7 | Do. New, £4 paid | 5—5½* | .. | 5 1 10 |
| 50,000 | 10 | Aug. 30 | 14 | Bourne- mouth Gas and Water — 10 p.c. | 28—29 | .. | 4 16 7 |
| 51,810 | 10 | ,, | 7 | — B 7 p.c. | 17—17½ | .. | 4 0 0 |
| 53,200 | 10 | ,, | 6 | — Pref. 6 p.c. | 15—16 | .. | 3 15 0 |
| 380,000 | Stk. | Aug. 15 | 12½ | Brentford Consolidated | 260—265 | .. | 4 14 4 |
| 300,000 | ,, | ,, | 9½ | Do. New | 198—203 | .. | 4 13 7 |
| 50,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 120—125 | .. | 4 0 0 |
| 206,250 | ,, | June 14 | 4 | Do. 4 p.c. Deb. | 103—106 | .. | 3 15 6 |
| 220,000 | Stk. | Sept. 27 | 11½ | Brighton & Hove Orig. | 230—235 | .. | 4 15 8 |
| 246,320 | ,, | ,, | 8½ | Do. A. Ord. Stk. | 163—168 | .. | 4 18 3 |
| 460,000 | 20 | Sept. 27 | 10 | British | 41—42 | +½ | 4 15 3 |
| 104,000 | Stk. | Aug. 15 | 6 | Bromley, Ord. 5 p.c. | 121—125 | .. | 4 16 0 |
| 165,700 | ,, | ,, | 4½ | Do. do. 3½ p.c. | 91—94 | +1 | 4 15 9 |
| 500,000 | 10 | Oct. 12 | 7 | Buenos Ayres (New) Ltd. | 11½—12 | .. | 5 16 8 |
| 250,000 | Stk. | June 28 | 4 | Do. 4 p.c. Deb. | 96—98 | .. | 4 1 8 |
| 150,000 | 20 | July 12 | 8½ | Cagliari, Ltd. | 24—26 | .. | 6 6 11 |
| 100,000 | 10 | Sept. 27 | 10 | Cape Town & Dis., Ltd. | 14—15 | .. | 6 13 4 |
| 100,000 | 10 | Oct. 26 | 4½ | Do. 4½ p.c Pref. | 9½—10 | .. | 4 10 0 |
| 50,000 | 50 | Nov. 2 | 6 | Do. 6 p.c. 1st Mort. | 50—52 | .. | 5 15 5 |
| 50,000 | Stk. | June 28 | 4½ | Do. 4½ p.c. Deb. Stk. | 98—100 | .. | 4 10 0 |
| 157,150 | Stk. | Aug. 15 | 5 | Chester 5 p.c. Ord. | 108½—110½ | .. | 4 10 6 |
| 1,443,280 | Stk. | Aug. 30 | 5⅛ | Commercial 4 p.c Stk. | 110—113 | .. | 4 12 0 |
| 560,000 | ,, | ,, | 5 | Do. 3½ p.c. do. | 108—111 | .. | 4 10 1 |
| 475,000 | ,, | June 14 | 3 | Do. 3 p.c. Deb. Stk. | 84—86 | .. | 3 9 9 |
| 800,000 | Stk. | ,, | 6½ | Continental Union, Ltd. | 125—128 | .. | 5 1 7 |
| 200,000 | ,, | ,, | 7 | Do. 7 p.c. Pref. | 140—145 | .. | 4 16 7 |
| 432,070 | Stk. | Aug. | 5½ | Derby Con. Stk. | 122—124 | .. | 4 8 9 |
| 55,000 | ,, | July | 4 | Do. Deb. Stk. | 105—107 | .. | 3 14 9 |
| 486,090 | 10 | July 27 | 11 | European, Ltd. | 24—25 | .. | 4 8 0 |
| 354,060 | 10 | ,, | 11 | Do. £7 10s. paid | 18—19 | .. | 4 6 10 |
| 15,203,110 | Stk. | Aug. 15 | 4⅛ | Gas- light and Coke — 4 p.c. Ord. | 98—99 | .. | 4 8 11 |
| 2,600,000 | ,, | ,, | 3½ | — 3½ p.c. max. | 88—90 | .. | 3 17 9 |
| 3,799,735 | ,, | ,, | 4 | — 4 p.c. Con. Pref. | 106—109 | .. | 3 13 5 |
| 4,193,975 | ,, | June 14 | 3 | — 3 p.c. Con. Deb. | 84—86 | .. | 3 9 9 |
| 258,740 | Stk. | Sept. 13 | 5 | Hastings & St. L. 3½ p.c. | 98—103 | .. | 4 17 1 |
| 82,500 | ,, | ,, | 6½ | Do. do. 5 p.c. | 118—121 | .. | 5 7 5 |
| 70,000 | 10 | Oct. 12 | 11 | Hongkong & China, Ltd. | 19½—20½ | .. | 5 7 4 |
| 4,940,000 | Stk. | Nov. 14 | 8 | Imperial Continental | 181—184* | .. | 4 7 0 |
| 473,600 | Stk. | Aug. 15 | 3½ | Do. 3½ p.c. Deb. Red. | 95—97 | .. | 3 12 2 |
| 181,242 | Stk. | Aug. 30 | 6 | Lea Bridge Ord. 5 p.c. | 120—125 | .. | 4 16 0 |
| 306,083 | ,, | June 28 | 4 | L'rpool Unit'd Deb. Stk. | 110—112 | .. | 3 11 5 |
| £ | | | p.c. | | | | £ s. d. |
| 561,000 | Stk. | Aug. 30 | 10 | Liverpool United A | 229—231 | −1 | 4 6 7 |
| 718,100 | ,, | ,, | 7 | Do. B | 169—170 | .. | 4 2 4 |
| 144,140 | Stk. | Sept. 13 | 7⅛ | Maidstone 5 p.c. | 145—150 | .. | 5 1 8 |
| 75,000 | 5 | June 28 | 5 | Malta & Medn., Ltd. | 4½—4⅝ | .. | 5 5 3 |
| 560,000 | 100 | Oct. 1 | 5 | Met. of 5 p.c. Deb. | 101—103 | .. | 4 17 1 |
| 250,000 | 100 | ,, | 4½ | Melbourne 4½ p.c. Deb. | 100—102 | .. | 4 8 3 |
| 541,920 | 20 | Nov. 14 | 3½ | Monte Video, Ltd. | 11—12* | .. | 5 16 8 |
| 1,675,892 | Stk. | Aug. 15 | 4⅜ | Newc'tle & G'tesh'd Con. | 111½—112½ | .. | 4 2 3 |
| 406,025 | Stk. | June 29 | 3½ | Do. 3½ p.c. Deb. | 98—100 | .. | 3 10 0 |
| 15,000 | 10 | Aug. 30 | 10 | North Middlesex 10 p.c. | 20—21 | .. | 4 15 3 |
| 55,940 | 10 | ,, | 7 | Do. 7 p.c. | 13½—14½ | .. | 4 16 7 |
| 300,000 | Stk. | May 11 | 8 | Oriental, Ltd. | 153—156 | +1 | 5 2 7 |
| 60,000 | 5 | Sept. 13 | 7 | Ottoman, Ltd. | 5⅞—6⅞ | .. | 5 12 0 |
| 398,490 | 5 | Oct. 26 | 7 | Primitiva Ord. | 7⅛—8 | −⅛ | 4 7 6 |
| 796,980 | 5 | July 27 | 5 | Do. 5 p.c. Pref. | 5—5½ | .. | 4 15 3 |
| 488,900 | 100 | June 1 | 4 | Do. 4 p.c. Deb. | 96—98 | .. | 4 1 8 |
| 851,070 | 10 | Oct. 12 | 7 | River Plate Ord. | 12¼—12¾ | .. | 5 7 8 |
| 300,000 | Stk. | June 28 | 4 | Do. 4 p.c. Deb. | 96—98 | .. | 4 1 8 |
| 250,000 | 10 | Sept. 27 | 8 | San Paulo, Ltd. | 13½—14 | .. | 5 14 4 |
| 70,000 | 50 | July 2 | 5 | Do. 5 p.c. Deb. | 49—51 | .. | 4 18 0 |
| 135,000 | Stk. | Sept. 13 | 10 | Sheffield A | 244—246 | .. | 4 1 4 |
| 209,984 | ,, | ,, | 10 | Do. B | 244—246 | .. | 4 1 4 |
| 523,500 | ,, | ,, | 10 | Do. C | 244—246 | .. | 4 1 4 |
| 70,000 | 10 | Oct. 26 | 10 | South African | 15⅞—16⅛ | .. | 6 1 3 |
| 6,350,000 | Stk. | Aug. 15 | 5½ | South Met., 4 p.c. Ord. | 127—129 | .. | 4 5 3 |
| 1,895,445 | ,, | July 12 | 3 | Do. 3 p.c. Deb. | 84—86 | .. | 3 9 9 |
| 201,720 | Stk. | Sept. 13 | 8 | South Shields Con. Stk. | 156—158 | .. | 5 1 3 |
| 575,000 | Stk. | Aug. 15 | 5½ | S'th Suburb'n Ord. 5 p.c. | 123—126 | .. | 4 7 4 |
| 60,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 123—126 | .. | 3 19 4 |
| 112,533 | ,, | July 12 | 5 | Do. 5 p.c. Deb. Stk. | 128—133 | .. | 3 15 2 |
| 502,310 | Stk. | Nov. 14 | 5 | Southampton Ord. | 105—110* | +½ | 4 10 11 |
| 120,000 | Stk. | Aug. 30 | 6½ | Tottenham 4 p.c. and — B 3½ p.c. | 127—130 | .. | 5 0 0 |
| 388,020 | ,, | ,, | 5 | | 104—106 | .. | 4 14 4 |
| 137,500 | ,, | June 28 | 4 | Edmonton 4 p.c. Deb. | 103—105 | .. | 4 16 2 |
| 182,380 | 10 | June 14 | 8 | Tuscan, Ltd. | 10½—11 | .. | 7 5 6 |
| 149,900 | 10 | July 2 | 5 | Do. 5 p.c. Deb. Red. | 104—106 | .. | 4 14 4 |
| 193,742 | Stk. | Sept. 13 | 5 | Tynemouth 5 p.c. max. | 106—108 | .. | 4 12 7 |
| 30,000 | Stk. | Aug. 15 | 8 | Wands- worth and Putney A 5 p.c. | — | .. | — |
| 255,636 | ,, | ,, | 6½ | — B 3½ p.c. | 140—145 | +2 | 4 9 8 |
| 75,000 | ,, | ,, | 5⅝ | — C 3½ p.c. | 113—115 | .. | 4 17 6 |
| 79,416 | ,, | June 28 | 3 | — 3 p.c. Deb. Stk. | 82—85 | .. | 3 10 5 |
| 779,875 | ,, | Aug. 15 | 5⅛ | West Ham 5 p.c. Ord. | 104—106 | .. | 4 16 6 |
| 185,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 120—123 | .. | 4 1 4 |
| 193,300 | ,, | June 28 | 4 | Do. 4 p.c. Deb. Stk. | 103—106 | .. | 3 15 6 |

Prices marked * are 'Ex div."

Cincinnati has just been provided with new water-works which are ready to furnish about 12 million gallons daily to the high-service system of the city. The water is not filtered, as it will be some time before the purification works are built.

In reference to an application for sanction to a loan for construction of water-works at Saxmundham, a letter has been received from the Local Government Board to the effect that a drainage system must be carried out at the same time. This was the view expressed by certain ratepayers when the local inquiry was held.

At the meeting of the Sweetmeat Automatic Company last Tuesday, the Chairman (Mr. Touche) stated that the gross takings represented 32,831,310 pennies in 1905, and this year the total was 32,573,278; being a decrease of 258,032 pennies, or £1075. This was due to the fact that profitless business had been eliminated. A novel feature had been the disclosure of the scarcity of copper coin. The Company had not been able to supply to the full extent customers for their coin. The banks had applied for more pence than they had been able to let them have; and the Company had asked the Mint authorities to ease the situation. The scarcity was not due to the advance in copper, but to the locking of it up in gas-meters.

On Thursday week there was a breakdown of the electric lighting in the town of Stirling, which lasted nearly an hour. The greater part of the town was affected, and much inconvenience was caused to the public.

We learn that at the West of England Manufacturing and Industrial Exhibition, which has just been held at Plymouth (as noticed in last week's issue of the "JOURNAL," p. 476), Messrs. A. E. Podmore and Co., were awarded a gold medal for intensive gas lighting with their patent dust-proof bunsen burner lamp.

Messrs. Joseph Taylor and Co. have received orders for a 1½-inch solid plate lead saturator, fitted with well for either fishing or steam-ejecting, to the order of Messrs. Mackey-Seymour, Limited, for the Emley Moor Collieries. An exactly similar order has been received for a 5-feet square saturator, with well and discharger complete, for another set of coke-ovens, including four large acid tanks, mother-liquor tank, drainer, &c. The firm have a further order for one of their latest makes of open bell saturators, timber-framed, including a large order for acid tanks, mother-liquor tank, draining table, &c., as well as orders for a solid plate lead saturator for the Teignmouth Urban District Council Gas Department.

## NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

*No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.*

**COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.**

**Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.**

**Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.**

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**Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.**


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**O'NEILL'S OXIDE**
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

**SPENT OXIDE PURCHASED IN ANY DISTRICT.**

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

**WINKELMANN'S**
**"VOLCANIC" FIRE CEMENT.**
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism London."

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Offices: Commercial Buildings, LEEDS.
Correspondence invited.

**SULPHATE OF AMMONIA**
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

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**JOHN E. WILLIAMS AND CO.,**
LOWER MOSS LANE,
MANCHESTER, S.W.
Telegrams: "ENAMEL." National Telephone 1759.

**THE KEITH LIGHT.**
OVER 3000 INSTALLATIONS IN DAILY USE.
**SEE illustrated advertisement in next week's issue.**
JAMES KEITH AND BLACKMAN CO., LTD., 27, Farringdon Avenue, LONDON, E.C.

**GAS OILS.**
**MEADE-KING, ROBINSON, & CO.**
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

**PATENTS AND TRADE MARKS**
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

**J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.**
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
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**THE First Dutch Bogore Co., Ltd., HOLLAND.**
*General Manager (for England and Wales)—*
CHARLES E. FRY, LEAMINGTON.
*General Manager (for Scotland)—*
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

**TEMPERLEY TRANSPORTERS**
**FOR Rapid and Economical Handling** of Coal and Coke in Gas-Works.
Next Illustrated Advertisement will appear on Nov. 27.
TEMPERLEY TRANSPORTER COMPANY,
72, BISHOPSGATE STREET WITHIN, LONDON, E.C.
Telephone: 365 LONDON WALL. Telegrams: "TRANSUMO."

**AMMONIACAL Liquor wanted.**
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

**TAR AND LIQUOR WANTED.**
Best Prices paid.
DENT AND CO.,
Ouse Chemical Works, SELBY.

**SULPHURIC ACID for Sale, specially** suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

**BENZOL**
AND
**CARBURINE FOR GAS ENRICHING.**
ALSO
**THE MAXIM PATENT CARBURETTOR.**

For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, BISHOPSGATE STREET WITHOUT,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

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SPENT OXIDE PURCHASED.
**BALE'S FIRE CEMENT.**
**PAINT FOR GAS-WORKS**
**BALE & CHURCH,**
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**SULPHURIC ACID.**
**SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.**
**SPENCER, CHAPMAN, & MESSEL, LTD.**
(with which is amalgamated WM. PEARCE & SONS, LTD.),
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

**BRISTOL RECORDING GAUGES AND THERMOMETERS.**
J. W. & C. J. PHILLIPS, 23, COLLEGE HILL, LONDON, E.C., and 7, Park Square, LEEDS.

**INCREASE YOUR MAKE.**
**SEND for Particulars of the "RAPID" Carburettor.** Why be short of Gas when you can stretch the make from 1000 to 2000 cubic feet per ton, without any difficulty?
BIGGS, WALL, & Co., 13, Cross Street, Finsbury Pavement, LONDON.

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**PREPARED from Pure Iron.**
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
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**GAZINE—A radical Solvent and Preventative** of Naphthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
Supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim Street Chambers, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

**TO METER MANUFACTURERS.**
TESTING METER INDICES.
**INVENTOR who has solved the problem** to verify Meter indices *in situ* invites inquiries. A great utility for Company or Consumer in detecting any error of indices. Indices need not be taken out of Meter.
Apply, to No. 4668, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**ROBERT DEMPSTER & SONS, Ltd.,** Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS ELLAND.

**GAS TAR wanted.**
BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

**THE Directors of the Bristol Gas** Company desire to THANK APPLICANTS for the post of Assistant-Engineer, and to say that the POSITION HAS BEEN FILLED.

**ADVERTISER, a man of good Educa**tion (38 years of age), desires position as ASSISTANT to Secretary of Gas, Water, or Manufacturing Company. Tall and Active. Many years Experience in Book-keeping, good Correspondent, and understanding the French Language. Salary not so much an object as the wish to secure a position of permanence and good prospects.
Address No. 4676, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**RESIDUALS, Rental, and General** Clerk, or Collector and Meter Inspector. Young Man would like position as above, in fairly large works, with view to Permanency and Improvement. Seven Years' business Experience (Three Years in 56-Million Works). Age 22. Total Abstainer. Good References.
Address No. 4678, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WANTED, at once, a Manager of Gas** and Water Works. Good Experience indispensable.
Salary, £350, with House, Coal, and Light.
Apply, giving full Particulars and Three References, to THE RHYMNEY AND ABER VALLEYS GAS AND WATER COMPANY, 9, Windsor Place, CARDIFF.
Nov. 12, 1906.

**WANTED, a Secretary and Manager** for the Aberdare Gas-Works.
Salary, £250 per annum, with House, Coal, and Gas.
Applications, stating Age and Experience, and enclosing not more than three Testimonials, to be sent to the Chairman of the Company, Mr. Benjamin Jones, at the Gas Offices, Aberdare, on or before Nov. 29, 1906.
D. M. JOHN.
Secretary, *pro tem.*
Gas Offices, Aberdare,
Nov. 9, 1906.

**WANTED, some really competent** FITTERS who are prepared to open business in various Towns to Sell and Fix "Ecliptic" Fittings, and no others, with a view to their becoming Sole Agents for a particular District. A Stock will be provided on Easy Terms and a Liberal Discount given. None but men with the best References and Abilities need apply.
Apply, giving full Particulars, to Mr. JOHN REID, Ecliptic Fitting Department, Gas Company, Bond Gate, NUNEATON.

**SOUTH AMERICA, PACIFIC SIDE.**

**WANTED, for a gravitation scheme** of Water-Works, an outside man who thoroughly understands all work relating to Laying Mains, Services, Meters, &c., and effecting all repairs incident to the undertaking, on a line of main of about 60 miles. Must be capable of taking Full Charge of the Water Distribution on the whole of the line, and of being able to generally assist and take active part in any branch of management.
Apply, stating Age, Salary, Qualifications, &c., to "R. A.," care of J. W. VICKERS, 5, Nicholas Lane, Lombard Street, LONDON, E.C.

**PORTSEA ISLAND GAS-FITTINGS COMPANY, LIMITED.**

**WANTED, an experienced Outside** Foreman. Must be used to the Control of men, Estimating, also Iron Barrel and Compo. work. Automatic Installations, and General Gas-Fitting. Must be steady and have good Character. Age not to exceed 38. Applicants should be cyclists, so as to be in position to make daily inspections of the various jobs.
Applications, by letter only, with *copies* of not more than Three Testimonials, endorsing same "Application for Outside Foreman," to J. D. ASHWORTH, General Manager, Portsea Island Gas-Fittings Company, Ltd., Park Road, PORTSMOUTH.

**WANTED, a Copy of Hartley's Book on** "GAS MEASUREMENT."
Full Particulars to T. SHAW, 147, Ethelred Street, LAMBETH, S.E.

**WANTED to purchase, Gas and Water** WORKS PLANT, and good second-hand Gas and Water Mains and Connections. Good price given.
WATER WORKS, LIGHTING, AND POWER INVESTMENT CORPORATION, 99, CANNON STREET, E.C.

**FOR SALE, cheap, a Station Meter,** Cylindrical Case, Cast Iron Cradles, 8-inch Connections and Valves. Capacity, 6000 cubic feet per hour. Just displaced for larger size.
Apply MANAGER, Gas-Works, Farnham, SURREY.

**GAS Exhauster and Steam Engine** (combined) FOR SALE. Capacity, 15,000 Cubic Feet per hour. Excellent Condition. Recently overhauled by Makers. Replacing with larger. May be seen working.
Particulars from ALBERT E. LAYTON, Gas-Works, REDDITCH.

**FOR SALE, the "Gas Journal" from** 1859 to 1878, bound in volumes.
Apply to the WINSTANLEY COMPANY, Newton Chambers, BIRMINGHAM.

**GAS PLANT for Sale—I can always offer** NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

**GAS PLANT FOR SALE.**

**OWING to the removal of the Gas-** Works, the Berkhampstead Gas Company have FOR SALE the following PLANT:—
Four Purifiers, 8 feet square, with Centre Valve.
One 6-inch Parkinson Governor.
One Station Meter for 3000 feet per hour.
One Exhauster passing 4000 feet per hour.
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Lengths of Hydraulic Main and Retort Mouthpieces.
One Gasholder, 50 feet diameter.
Can be inspected on application at the GAS-WORKS, BERKHAMPSTEAD.

**SHOTLEY BRIDGE AND CONSETT DISTRICT GAS COMPANY.**

**THE Directors of this Company are** prepared to receive TENDERS for the whole of the TAR produced at their Works from the 1st of January to the 31st of December, 1907.
Quantity, 70,000 to 80,000 Gallons.
Tenders to be sent to the undersigned not later than the 11th of December, 1906.
M. RICHLEY,
Secretary.
Office: Front Street,
Shotley Bridge.

**BOROUGH OF ABERAVON.**

**THE Gas Committee invite Tenders** for the Supply and Delivery of:—
3380 yards of 3-inch Cast-Iron Gas-Mains.
1020 " 4 " " "
600 " 8 " " "
Further Particulars to be obtained from Mr. A. J. Bond, Engineer and Manager.
Tenders, to be marked "Tenders for Mains," to be delivered to the undersigned not later than Dec. 1 next.
The Committee do not bind themselves to accept the lowest or any Tender.
By order,
M. TENNANT,
Town Clerk.
Nov. 14, 1906.

**ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.**

**MR. ALFRED RICHARDS begs to** notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing such Capital, and also for including in these Periodical Sales Gas and Water Stocks and Shares belonging to Private Owners, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
**BARKING GAS COMPANY.**
NEW ISSUE OF 500 £10 SIX PER CENT. PREFERENCE SHARES.
**MR. ALFRED RICHARDS will Sell the** ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 27, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
**HARROW AND STANMORE GAS COMPANY.**
NEW ISSUE OF 400 £10 "C" SHARES,
AND
£4989 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
**MR. ALFRED RICHARDS will Sell the** ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 27, at Two o'clock, in Lots.
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By order of the Directors of the
**SOUTH ESSEX WATER-WORKS COMPANY.**
NEW ISSUE OF £15,000 FIVE PER CENT. ORDINARY STOCK.
**MR. ALFRED RICHARDS will Sell the** ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 27, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
**LEA BRIDGE DISTRICT GAS COMPANY.**
NEW ISSUE OF £12,000 CONSOLIDATED ORDINARY STOCK.
**MR. ALFRED RICHARDS will Sell the** ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 11, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

**REDHILL GAS COMPANY.**

SALE OF ORDINARY "B" STOCK.

**NOTICE is Hereby Given, that it is** the intention of the said Company to SELL BY TENDER, £5000 of ORDINARY "B" STOCK of and in the Redhill Gas Company.
The last day for the reception of Tenders will be Tuesday, the 4th day of December, 1906, at Twelve o'clock at noon.
Forms of Tender, with Particulars of Sale and Conditions of Tender attached, can be had upon application at the Company's Office, Brighton Road, Redhill.
By order,
J. PATERSON,
Secretary.
Redhill, Surrey,
Nov. 12, 1906.

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**AND ITS COMPOUNDS.**
By
**J. GROSSMANN, M.A., Ph.D., F.I.C., &c.**

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Manufacture and keep in Stock at their Works (also large Stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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